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CHEMICAL ENGINEERING

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SIXTH ANNUAL REVIEW AND PROGRESS NUMBER

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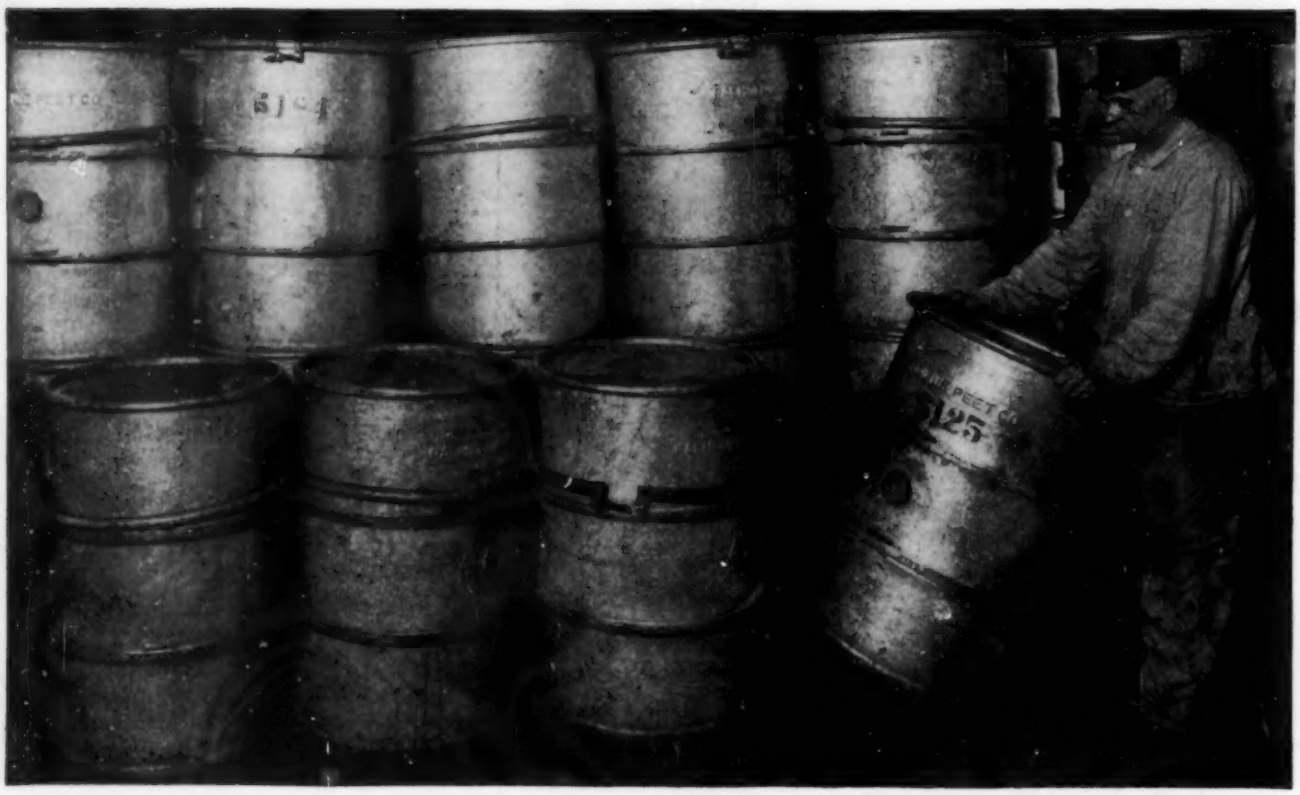

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VOLUME THIRTY SIX - NUMBER ONE

JANUARY, 1929

S. D. KIRKPATRICK, *Editor*

Progress *for* Profits

LAST YEAR was one of reassuring progress in chemical engineering. Technology made many significant advances and the various industries reported substantial gains in business activity. Uniformly favorable prospects are observed with encouraging unanimity by those who are hardy enough to project these trends into the future. And yet just this note of caution seems warranted: Further progress in the chemical engineering industries demands a more useful knowledge of economics, particularly in relation to technical developments.

IF BUSINESS is to merit professional status it must be conducted on a more rational basis. If the methods of scientific research—i.e., the determination of the facts and their honest interpretation in terms of industrial procedure—are worth while in production, then economic and commercial research should be just as profitable in marketing, finance and administration. To focus attention on the important objectives of commercial research and the means of applying it as a rational basis for technical development is one of the purposes of this Sixth Annual Review and Progress Number.

AS THE CHEMICAL engineering industries grow in size and influence, increasing attention must be given to foreign markets and to the merchandising methods of our European competitors. To contribute to this international viewpoint and to orient the status of American industry with respect to world developments, this issue of *Chem. & Met.* presents two authoritative articles from the Bureau of Foreign and Domestic Commerce. These are effectively illustrated in a special wall chart and world map supplement showing the raw material resources, size, location and trade of the principal countries of the world.

SUPPLEMENTING these economic and statistical studies are the reviews of the year's advances in technology and of improvements of process and equipment. All have contributed to the progress of 1928. All will contribute to the profits of 1929 if our industries continue to build on sound economic principles.

For PROFITS, Industry is Turning to COMMERCIAL RESEARCH

By Chaplin Tyler
Lazote, Incorporated
Wilmington, Del.

As author of the standard work on "Chemical Engineering Economics" and as a former member of the editorial staff of *Chem. & Met.*, Mr. Tyler writes from a broad knowledge of the field and objectives of commercial research. Prior to his editorial work, Mr. Tyler served as a research associate in the Laboratory of Applied Chemistry of the Massachusetts Institute of Technology. He received his bachelor's degree in chemical engineering from Northeastern University in 1920, and his master's degree in the same subject from M.I.T. in 1923.

SCARCELY more than a decade ago, American industry as a group became "research conscious." So pronounced have been the results that it is hardly necessary to dwell on the possibilities of scientific research. It is sufficient to note that in those branches of industry that lack a research foundation, recent financial returns have been little or nothing, even in the face of an unprecedented volume of business and national prosperity. But despite the acceptance of the research idea, the practice of research has been confined largely to the technical processes of production. Industrial research of the future is certain to broaden; it will utilize to a far greater extent the principles of economics, and it will penetrate the problems of marketing, distribution, and finance. For want of a better term, research as applied to the business side of industry has been called "commercial research."

Commercial research is not new, but it has new possibilities. Consider, for example, the practice of accounting. It must be admitted that, whereas the accounting practices in finance and in trading are virtually standardized, accounting as applied to production, that is, cost accounting, still is an unfamiliar tool in a large proportion of industry. Similarly, commercial research is a tried and effective tool and one that should have far wider use

As is indicated in the accompanying chart, the final objective of commercial research is the presentation and interpretation of information in such a manner that rational administrative action or formulation of policy is facilitated. Commercial research is therefore in no sense a substitute for judgment, but it can be an aid to judgment, in that administrative "guesstimation" is reduced to a minimum. In the present article it is proposed to indicate briefly how commercial research relates specifically to the problems of chemical industry. The discussion will comprise first, the methods or technique of commercial research, and second, the personnel and organization that are required.

Sources of Facts:—Since the foundation of commercial research comprises facts, a consideration of the sources of facts forms a convenient starting point for discussion. The chart which accompanies this article indicates certain sources of facts, namely, government reports, the periodical literature, reference books, trade associations, corporate reports, consultants, and private files. Needless to say, there are other sources of facts; however, it is possible to do effective commercial research using only these sources. For a more detailed discussion of sources of facts, the reader should refer to the article by C. R. DeLong, appearing in the present issue.

Examples of the character of facts available from the various sources of information may prove suggestive to those interested in commercial research: (1) Government reports are practically essential, the *Biennial Census of Manufactures* being the most complete governmental report on production. (2) Periodical literature, often containing government matter, occasionally initiates valuable statistical information. The government itself publishes several excellent periodicals. (3) Reference books often contain handy and original critical data. (4) Trade associations are increasingly emphasizing dissemination of commercial data through publications. (5) Corporate reports in exceptional cases publish detailed operating information. (6) Consultants yield a specialized intensive service on costs, indispensable to complete commercial surveys. (7) Private files, when available, often contain surprisingly valuable reports.

ATTENTION is called to certain publications that are known to every specialist in commercial research, and yet that are hardly ever used with maximum effectiveness. First among these sources are the newspapers, and considering the limitations of time, the *United States Daily*, the *Wall Street Journal* and the *New York Times* have proved profitable for regular reading. A second class of publications of considerable general value are the weekly business periodicals, and a third, not for reading, but for reference, are the various commercial and financial directories and reports.

By using the sources of facts suggested in the previous discussion, it is possible to study any of the three basic problems of commercial research, that is, process studies, market studies, and distribution studies, which together constitute the complete report for the administrator.

Process Studies: — In estimating production costs, whether of an existing process or of a projected process,

the general procedure is similar. First, it is desirable to reduce the process to the constituent unit processes, expressed in flow-sheet form. The flow sheet should indicate not only the quantities of materials consumed and products yielded, but also the quantities of materials at each step in the process, the power requirements, steam requirements, heats of reaction, process temperatures, and time lags in the process. The flow sheet is invaluable as a basis for estimating costs of projected processes, and will prevent serious errors of omission.

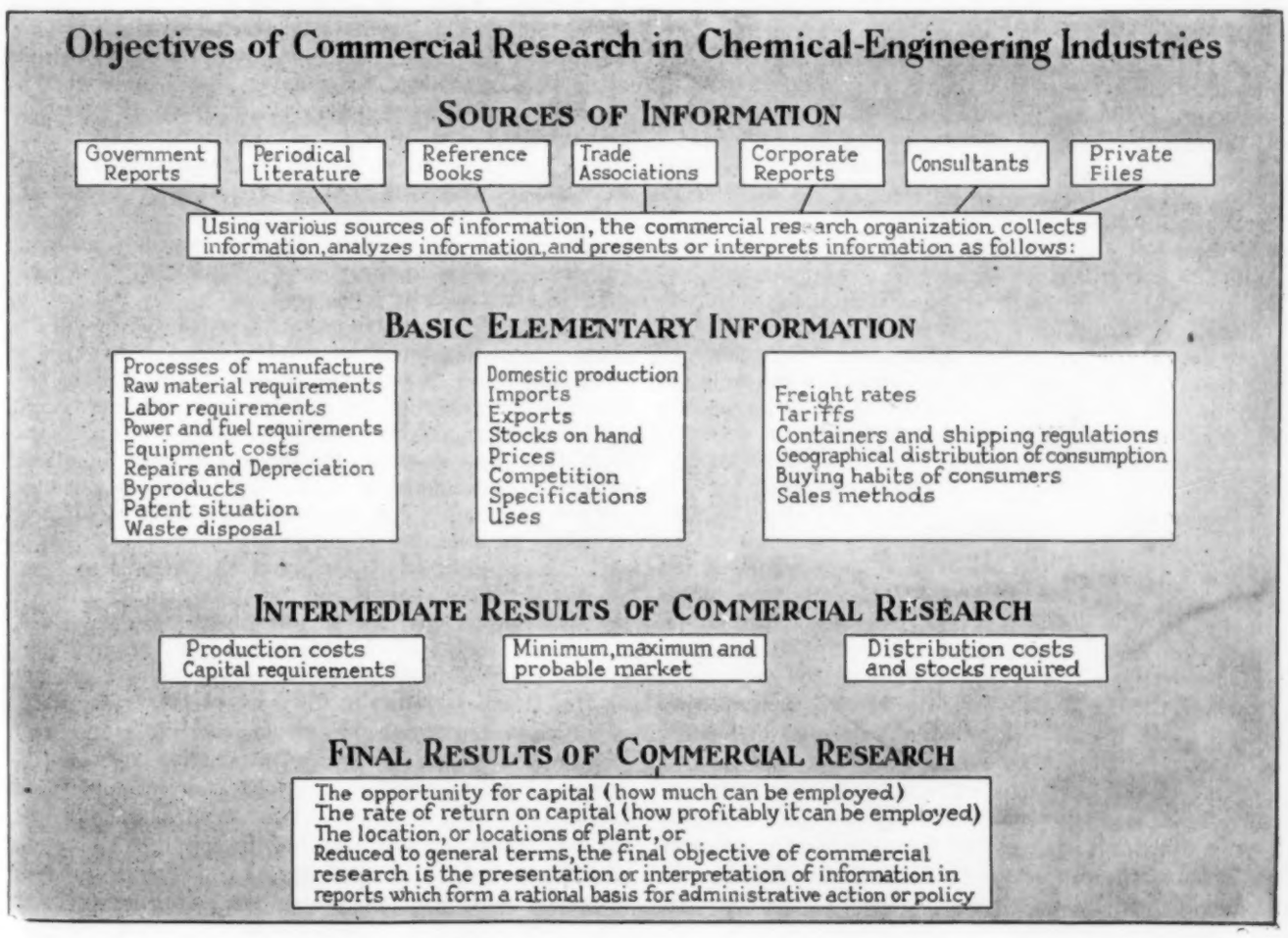
The raw material costs will be the product of the quantities indicated on the flow sheet and the unit cost of material delivered at the point of use. That is, to the cost of material at source must be added freight, handling charges, and storage charges if the supply is irregular. In addition to primary raw materials, allowance should be made for indirect materials, as for example, packages, repairs material, and supplies. In the estimate of material costs, sources of supply should be considered. In the ideal case, the material should be (1) domestic in origin; (2) available indefinitely in large quantity; (3) available from at least two major sources which are not controlled by the same ownership. Examples of mineral materials which satisfy these conditions are coal, limestone, phosphate rock, and salt; and of manufactured materials, ammonia, caustic soda, methanol, and sulphuric acid. When adequate supply is not assured at reasonable price, then it becomes wise to consider either control of supply or use of satisfactory substitute materials.

Labor costs usually are divided into operating or direct labor, and repairs or indirect labor, including in both divisions, the wages of foremen and supervisors. Labor requirements are estimated by those familiar with the constituent unit processes, and the wage rates are of course determined by the skill required and by the location of plant.

Steam and power costs are interdependent when the exhaust steam from prime movers is used in processes, but otherwise power is purchased, and steam is generated primarily for process use. Steam, power, and fuel requirements should be closely predictable from study of analogous processes. Works general expense and works salaries likewise should be estimated easily.

CAPITAL costs, depreciation, taxes, and insurance are of course based on the investment in plant, buildings, land, and improvements. These items must be estimated carefully, since an accurate knowledge of the capital investment is essential, not only in process cost estimation, but also in the estimation of the rate of return on such capital. In estimating capital requirements, the estimate for plant, buildings, and improvements should include interest and insurance during construction; allowances for engineering design and contractor's profit; allowances for the installation of outside lines and services; and for the improvement of the plant site, that is, roads, fences, sewers, railroad spurs, docks, and interplant communication lines. Furthermore, ample working capital should be allowed. The minimum working capital is the sum of the average inventories of raw materials, materials in process, finished products, the average of accounts and bills receivable, and the cash requirements for at least three months' operation.

The tendency in cost work is to under-estimate, due largely to the neglect of certain items, as for example, evaporation or drying costs; or of lack of knowledge


Objectives of Commercial Research in Chemical-Engineering Industries
SOURCES OF INFORMATION
Government Reports
Periodical Literature
Reference Books
Trade Associations
Corporate Reports
Consultants
Private Files
Using various sources of information, the commercial research organization collects information, analyzes information, and presents or interprets information as follows:
BASIC ELEMENTARY INFORMATION
Processes of manufacture
Raw material requirements
Labor requirements
Power and fuel requirements
Equipment costs
Repairs and Depreciation
Byproducts
Patent situation
Waste disposal
Domestic production
Imports
Exports
Stocks on hand
Prices
Competition
Specifications
Uses
Freight rates
Tariffs
Containers and shipping regulations
Geographical distribution of consumption
Buying habits of consumers
Sales methods
INTERMEDIATE RESULTS OF COMMERCIAL RESEARCH
Production costs
Capital requirements
Minimum, maximum and probable market
Distribution costs and stocks required
FINAL RESULTS OF COMMERCIAL RESEARCH
The opportunity for capital (how much can be employed)
The rate of return on capital (how profitably it can be employed)
The location, or locations of plant, or
Reduced to general terms, the final objective of commercial research is the presentation or interpretation of information in reports which form a rational basis for administrative action or policy

regarding the magnitude of repairs or depreciation expense; or of bias, due to the desire of the estimator to produce an attractive result. Obviously, the reliability of the cost estimate depends largely upon the thoroughness with which the preliminary experimental work and engineering have been done.

AMONG the unexpected factors that may increase costs may be listed fume control, waste disposal, water purification or softening, and spoiled or sub-standard product. On the other hand if byproducts are produced, the market value of these (less the cost of further processing) should be credited to the principal product.

The estimation of costs is a matter of simple accounting procedure once the flow sheet is prepared, and the capital requirements are determined, provided that only one principal product is obtained. Not all chemical processes are so simple, however, that only one product of marketable value results from the reactions. For example, in wood distillation processes, costs must be distributed among the several products (sometimes called joint products) the most important of which are crude methanol, acetate of lime, tar, and wood charcoal. Under present trade conditions, the wood distillers cannot determine market prices for these products, merely as a result of a cost distribution study, due to the fact that prices of methanol and acetate of lime are controlled by the prices of synthetic methanol and acetic acid, and even the price of wood charcoal is apparently not controlled by the wood distillers. Nevertheless, it is desirable to know the true costs for each product. The various procedures for cost distribution cannot be described even briefly in this article, but this information is readily available.

MARKET studies probably comprise the greater part of the average commercial research program. The market study is essential in the determination of the production schedule, and therefore is the first task to be done. If the results of the preliminary market study are favorable, then expenditure for the development of process is better justified than on the prospect of favorable technical results alone.

The market study is essentially a study of consumption. With few exceptions, the consumption of important chemical commodities can be determined from the government statistics by deducting the quantity of domestic exports from the sum of production and imports entered for consumption. When possible, the approximate consumption thereby determined should be corrected for differences in the stocks on hand. Expressed algebraically,

> Consumption = Stocks on hand at beginning of period + Production + Imports entered for consumption — Stocks on hand at end of period — Domestic exports.

A weakness of the foregoing general procedure is the dependence upon the biennial production statistics, which usually are from one to two years old when issued by the Bureau of the Census, and the fact that the commodity under investigation may not be enumerated separately. However, these remarks should not be construed as being critical of the excellent statistics appearing in the Census of Manufactures. It is obvious that the returns for an industry cannot be published until completed questionnaires have been received from every manufacturer; and the manufacturer, in turn must complete his records after the close of the census year. Government statistics on production are by no means confined to the Biennial Census of Manufactures. For example, the Bureau of Mines publishes annually the statistics of minerals production (*Mineral Resources of the United States*), and in fact the Bureau reports petroleum production monthly. The Department of Commerce also issues monthly statistics of certain other chemical commodities, for example, methanol and acetate of lime from wood distillation, and superphosphate.

When the production is not reported by the Government or other reliable agency, the investigator has ample opportunity to demonstrate his resourcefulness. Perhaps the most useful general procedure is to list all the important applications of the commodity, after which it is usually possible to apply factors that will indicate the consumption for each use. The final result thus obtained is of course an approximation; nevertheless such estimates are useful. The procedure is useful also in estimating the possible consumption of new products, or the possible extension of consumption of products already in use.

USUALLY the administrator is interested more in that fraction of consumption which can be captured, rather than in the total consumption; consequently the complete market study should include as far as possible certain analyses of total consumption. Such analyses may show consumption according to uses, according to geographical areas, and according to individual consumers (companies or establishments). The administrator is then in position to estimate consumption by consideration of freight rates, the attitude of consumers toward his company, and the adaptability of his product to particular uses.

The price history of the commodity is of interest, as it indicates, when compared with estimated production costs, the probable profits and also the possibility of increasing consumption through price reduction. Here again is a fertile field for commercial research—that is, the prediction of consumption as a function of price. In general, an attempt to increase consumption substantially through price reduction should be preceded by technical development that will assure progressively decreasing production costs with increased outputs and with the investment of new money. In any thorough study of prices in relation to the volume of sales, the following price levels should be considered:

1. The price at which imports, if any, would practically cease. Normally this price would depend upon the cost of production in the country of origin, plus freight and handling charges, plus import duty, plus a minimum profit to the producer and his agent.
2. The price at which the commodity will be substituted for other commodities, or will find extended use for present purposes. For example, the choice of an acid or alkali may depend largely upon price.
3. The price at which the commodity is able to stand additional freight charges and therefore can be marketed in new domestic territory, or possibly in export markets.
4. The price at which business can be captured permanently from domestic competitors. This is difficult to predict unless radically different processes are used, in which case patent rights would have the same effect as a protective tariff. However, production costs tend to become equalized, and it is probably wiser and more profitable in the long run to increase sales volume through the development of new uses, and through the elimination of imports (when the tariff actually is protective) than to engage in price wars with domestic competitors.

Distribution and Marketing Costs:—As suggested elsewhere in this article, the costs of distribution affect the volume of sales. Freight is by far the most important factor affecting competition, considering, of course, only distribution costs. Knowing the location of competing producers it is possible to determine traffic areas or zones which indicate the markets possibly obtainable through advantageous freight differentials. Portland cement and lime are examples of commodities of comparatively low value per ton, in the marketing of which freight is a controlling factor.

The "buying habits" of the consuming industries are another important consideration. It is necessary for the producer to know through what channels the commodity will be marketed. The packaging requirements must be studied, in relation to shipping regulations of the Interstate Commerce Commission, in relation to the preference of consumers, and also in relation to cost to the producer. Packaging problems vary in difficulty from the simple bulk shipment of solids to the use of expensive returnable containers for compressed gases.

Seasonal demand is also an important factor in marketing, as it determines the size of stocks on hand may affect the purchase of raw materials, and the production schedules. The superphosphate fertilizer industry is illustrative of the effect of seasonal demand.

Specifications must be considered in relation to proposed products, particularly as regards possible changes in composition or physical properties upon storage or transport. Chlorinated lime is an example of a commodity susceptible to deterioration, that is, loss of chlorine, particularly in warm weather. Certain salts "set up" or cake during storage and thus become less acceptable to the consumer.

ORGANIZATION for Commercial Research:—Usually the commercial research organization will grow from a modest beginning, in fact it may start as the part-time interest of one or two men. However, it would appear most desirable to start with the full time of one man, the staff gradually increasing as warranted by the results obtained on the smaller scale. Keeping in mind the breadth of the job, and the personal contacts that are involved, the man assigned to commercial research should possess the following characteristics:

1. Technical training: that is, the same minimum requirement demanded for chemical experimental work, which is the completion, in creditable manner, of a four-year course in a school of good standing.
2. Technical experience; that is, sufficient to grasp the essentials of various processes; an understanding of the fundamentals of industrial operations; and a knowledge of the organization of chemical industry.
3. Economic training: that is, knowledge of the fundamental principles underlying the economics of production, marketing, distribution, finance, and management.
4. Business experience: that is, familiarity with, and sound sense in matters of business practice.
5. Ability to express results with facility in satisfactory report form.

Although the foregoing specifications may appear to be unreasonably inclusive, they are in reality no more rigid than is required of a junior executive in the chemical industry, and obviously the responsibilities of commercial research are equally important.

While it is true that relatively few chemically-trained men have aptitude for commercial research, it is also true that relatively few such men are needed in industry. In the small chemical organization at least from 5 to 10 technical research men will be required to one commercial research man, and in the large organization the proportion of technical research staff will be still greater. The most effective ratio will depend upon the rate of growth of the organization, the nature of the business, and the complexity of the technical research problems.

The specifications purposely lack several items that might be included, as for example, "experience in commercial research." It is assumed that this experience is most useful when gained in a particular organization; furthermore, that men having the desired experience will be difficult to obtain. Among other specifications might be mentioned "personality," "ability to co-operate," etc.; these qualities, however, are considered prerequisite to any job of comparable importance in the industrial organization. Finally, it is possible to enumerate such specifications as knowledge of foreign languages and of statistical methods; but these are considered to be minor in importance.

PERSONNEL requirements for commercial research other than those already discussed, will be determined entirely by the work to be done. Efficient stenographic service is a prime essential, and of equal importance is efficient filing service, since the information files in any well-established commercial research program will be in constant use, for which reason material must be immediately accessible, despite the volume and complexity of subject matter. The extent to which the information file must be self-contained will be determined by the library facilities of the company. In many large companies the technical library facilities are such that nearly every essential reference book, periodical, and pamphlet is readily available. This is an invaluable aid and greatly simplifies the requirements of the commercial research library.

In the larger companies, a trained statistician may be employed advantageously, particularly in relation to historical studies of production, consumption, foreign trade, and prices. Needless to say, a complete statistical survey of an industry is an incalculable aid in subsequent commercial research, but usually it is inexpedient to make such a survey in preference to work of current interest.

CONSIDERING the nature of chemical industry it is advantageous to co-ordinate commercial research with technical development of research departments, rather than with either the sales or administrative departments. Under this arrangement a proposed process can be studied thoroughly from both the technical and commercial viewpoints before being submitted for consideration by other departments. It should be added, however, that those responsible for commercial research must necessarily consult freely such agencies within the company as may be of use, for example, the sales, purchasing, traffic, accounting, engineering, and production departments.

In conclusion, the final objective of commercial research is the presentation and interpretation of information (cost estimates, market surveys, etc.) in order to minimize the guess-work underlying administrative action or the formulation of policy. To this end, the economics of a project must be studied as thoroughly as the technology. No one will deny that well-directed technical research yields high returns, and it is submitted that systematic commercial research in chemical industry will be equally productive.

PRICE as a Determining Factor in Marketing Chemicals

By W. M. Rand

Vice-President and Sales Manager, Merrimac Chemical Company Boston, Mass.

Graduating from Harvard in 1909, Mr. Rand began a diversified business career that has given him a broad viewpoint on the marketing problems of chemical industry. At first engaged in banking, in various capacities, he later became treasurer of the City Fuel Company of Boston. He left this position in 1917 to join the United States Navy, where he served as lieutenant, senior grade. His connection with Merrimac dates from 1919, and he has served that company successively as treasurer, sales manager and vice-president.

VOLUME of sales of manufactured articles sold directly to the public and used in daily life depends upon price. If foodstuffs, articles of clothing, automobiles and scores of other products were cheaper, larger volume of sales would result. Price stimulates latent buying power until the point of absorption is reached, where no further sales would be made regardless of price reduction. The sale of newspapers is an example.

Industrial chemicals are not sold directly to the public. Ordinary fluctuations in price have little effect on the volume of sales. Revolutionary reductions in the price of a product bring about new uses and increased sales for that product while revolutionary price advances stimulate the use of substitutes and thereby reduce sales. Industrial chemicals include mineral acids, alkalis, solvents and salts, and are used for the most part as raw materials or as aids in the manufacture of other products. Rarely do they take such an important part in the price structure of the finished product that the costs of the chemicals materially change the price of the finished product.

By their nature chemicals are not easy to store or to handle. There is little incentive to store heavy chemicals at times of low prices with the intention of using or reselling them later. It is difficult to produce activity in a chemical market, even temporarily, by price reduction. A sales manager was asked by his plant manager to sell ten or twelve cars of sulphate of alumina, owing to the fact that rehandling the material to storage was increasing costs. The sales manager looked over his list of customers. Over eighty per cent were under contract. He knew that the customers of his competitors were likewise under contract. He could do one of two things: either cut the price of the spot market or ask his customers to favor him by stocking some sulphate. A reduction in price would do little good in comparison with the resulting injury to his market if the rumor should spread among his contract customers that he was running a bargain sale. To ask his contract customers to store alum would postpone the problem. His guardian angel must have been interested, for while he was pondering about it over night the orders for the twelve cars were received in the regular course of business. The fact that business was good that particular day did more to take care of surplus stock and to build up the plant manager's confidence in his sales department than any price reduction could have done.

No greater volume of paper would be produced if the prices of sulphate of alumina, rosin, satin white, salt cake or any other chemical were reduced. The paper industry does not depend on the chemical as far as the price of chemicals regulates its volume of sales. A woolen mill will use as much Glauber's salt at eighty cents a hundred pounds as it will at fifty cents. Price has little to do with the volume of chemical sales provided the price changes are not too drastic. That a prohibitively high price will always reduce sales is axiomatic.

Price cutting is the poorest stimulant of business. Price cutting is differentiated from price reduction in that it carries with it the idea that the price cutter, in order to obtain the business of his competitors, will sell at a lower margin of profit. Price reduction indicates that the entire industry on account of lower costs has reduced the price. Price reduction is constructive, price cutting destructive. Price cutting may change the time of buying or the source of supply but it creates no new business. A new entrant in a field may have difficulty in getting started at the price his competitor is quoting as the competitor has been long established in the field. At last under pressure the new comer cuts the price. He inevitably gets business, in fact he will be received with acclaim by part of the trade as their champion because he made the established company "cut the price." The market is lowered and an industry is injured. Purchasers first pleased with the reduction the competition has brought about now wonder whether they are paying more than their competitor. And when the war clouds roll away all the producers have sold at a loss. There has been some exchange of tonnage. The newcomer, if he has been successful, has brought some business at a loss. In order to put the industry on a sound basis the price goes to a higher level. How much more constructive it would be if a company made certain before it entered a new field that it had an advantage in costs by reason of lower raw materials, lower freights or a better process; that the market can absorb its produc-

tion; that there is reason for growth in the future. If these questions were satisfactorily answered before it entered the new business, there would be fewer disastrous price wars.

Instability of price is one of the chemical industry's great problems. In common with other industries the heavy chemical business needs stabilization of prices. The personnel in the industry cannot accomplish this without fear of infringement of the Sherman and Clayton Acts. It would be more constructive for the Government to proceed against a manufacturer for dumping material at less than cost, thereby causing loss of money, than to jail the manufacturer for agreeing with his competitors upon a fair market price.

The aim of the Sherman Act in preventing fixation of prices is being circumvented by the use of the open price association. A group of manufacturers meets, writes a "code of ethics" befitting its industry, agreeing to do away with all the destructive features of the industry. To this code each manufacturer subscribes. The new association then employes a secretary, to whom each member of the association sends his price lists. The secretary promptly informs each member of the price lists of his competitors. Theoretically any member can name any price he wishes. It is not on record what happens to a member who persistently names a lower price than the rest of the membership desired. Even if this system is a purely legal subterfuge to get around any price agreement by the members of the industry and even if it may infringe the Sherman Act in spirit, it is beneficial. At least it brings the members together legally. If any member breaks the code of ethics, he may be proceeded against under the Clayton Act, as doing business by unfair practices.

The larger part of the industrial chemical business is carried on by contract. A contract is a meeting of the minds whereby a buyer and a seller agree to do business for a certain period of time at stated prices, deliveries and terms. Owing to competition in the chemical business, the chemical contract has come to bind the seller, but has very little binding effect upon the buyer. Of course it is true that generally a chemical contract must be made out for the requirements of a buyer, for it is unreasonable to suppose that a buyer should take chemicals that he cannot use. Price protection clauses should be in no contract. It should be incumbent upon the seller, in order to hold the good-will of the buyer and to continue to do business with him, to meet new market conditions of his own free will. With the ordinary protection clause in force, the seller is obliged to meet, not market conditions, but the most antagonistic competitive conditions at all times during the term of the contract. It would be a benefit to the chemical industry if some chemical association could suggest a form of contract which everyone in the industry could endorse. This model contract need not discuss details.

MOST heavy chemicals are purchased in four classifications: (1) the large user; (2) the carload buyer; (3) the truckload buyer; (4) the less than truckload buyer. The first group is composed of manufacturers who use tremendous quantities of chemicals, enough to warrant the construction of plants of their own. Their business is important to any chemical manufacturer, for it will allow him to keep his plant in operation at all times. It may be termed "overhead" tonnage. The buyer is entitled to a lower price than are smaller users.

Group (2) consists of buyers who do not use sufficient quantities to become potential manufacturers. For this group, the backbone of the chemical trade, prices are established on which the entire market is based.

What regards group (3), during the last fifteen years the advent of the truck has changed the delivery of chemicals to a marked degree. It is convenient for the purchaser to have his chemicals delivered directly to the building in which they are to be used. The truck can accomplish this where the freight car could not. The results, however, from the seller's point of view have not been as satisfactory. Formerly one car was loaded, one bill of lading made out, one invoice sent, whereas now, for the equivalent of each carload, there must be three or four invoices and similar complications. This adds expense and the seller is entitled to a higher price.

The fourth group of buyers consists of those who buy in small lots, i.e., less than truckloads. There is little difference to the seller whether they buy one container or twenty. A charge should be made above the truckload price.

REVOLUTIONARY price changes are usually the result of technologic advances. In our age of chemistry discoveries of new methods of manufacture are constantly being made. These discoveries materially affect the volume of business. A few years ago there were manufactured in the United States 25,000,000 lb. of anhydrous ammonia, chiefly for use in refrigeration. This ammonia was manufactured for the most part by the purification of ammoniacal liquor. The prevailing price was approximately thirty cents to the consumer. This represented, then, a $7,500,000 industry. The electrolytic fixation of nitrogen from the air took the place of the old gas-liquor method of ammonia manufacture. Immediately the price dropped fifty per cent and possibilities of even lower prices were indicated. New markets were introduced which could not be served by high cost ammonia. Ammonia is now used extensively by the fertilizer industry and by the manufacturer of nitric acid. The immediate future for the market of ammonia is at least six or seven times the entire amount of the old market.

The electrolytic manufacture of chlorine brought that chemical from the shelf of the laboratory to the vast fields of industrial usefulness. The modern alkali industry was created by the discovery of the Leblanc process for the cheap manufacture of sodium carbonate.

Again, the material increase in price of a product attracts substitutes. As soon as the price of a chemical rises to a burdensome height, research laboratories become active in finding a substitute. Perhaps the cost of sulphur to the chemical industry is an example. Sulphur formerly was too expensive to use in the manufacture of sulphuric acid for industrial purposes and the greater part of the acid was made from iron pyrites. The Frasch process for the extraction of sulphur from the earth lowered the price. Immediately a great majority of the manufacturers of sulphuric acid turned from pyrites to sulphur for their raw material. Then the price of sulphur advanced and with the advancing price the producers of sulphuric acid are finding their way back to the less costly pyrites.

The laboratory in the end controls the destiny of chemical markets. The volume of future chemical sales will be frequently affected by those drastic price reductions which research ultimately motivates through the agency of its accomplishments.

Tapping the SOURCES of Data for Commercial Research

By C. R. DeLong

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The author is a recognized authority in economic matters affecting chemical industry. Before taking up his present work with the Federal electrochemical enterprises in 1926, Mr. DeLong had been head of the Chemical Division of the United States Tariff Commission. After graduating in chemical engineering from Ohio State in 1914 he joined the staff of the Federal Dyestuff Corporation in Kingsport, Tennessee, and later became connected with the Electron Chemical Company of Portland, Maine.

COMMERCIAL research, as the term is becoming generally used, designates the search for commercial facts to guide industry in planning technical programs, in extending markets for existing products, in determining policy as to new products, and in ascertaining the most economical location for future plant expansion. To make commercial research serve these ends efficiently, there is involved the segregation, compilation, analysis and interpretation of many facts from widely varying sources. It is the purpose of this article to show the principal factors which go to make up the composite picture of the "competitive market situation" and to indicate how this information is put to practical application.

Of the various sources that must be tapped for commercial research information, the published data on domestic production are the most complete. The principal first-hand sources of production data are as follows:

Bureau of the Census— U. S. Department of Commerce	Bureau of Mines—
Census of Manufactures—Biennial. Monthly, quarterly and semi-annual statements on selected industries.	Mineral Resources — Annually. Minerals and Metals, Salts and other products by direct processing of the ores.

U. S. Tariff Commission—

Census of Dyes and Synthetic Organic Chemicals—Annually. Reports on special	commodities, especially under Section 315 (flexible provisions) of the tariff act of 1922.

Trade Associations—

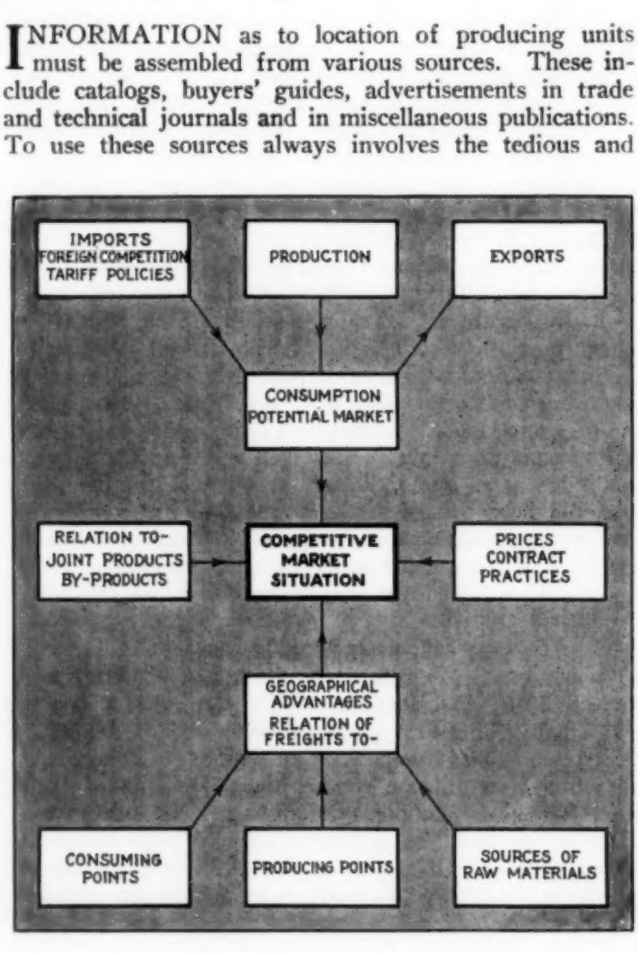
Some associations collect and publish production figures. In	many cases this is in co-operation with the Bureau of the Census.

There are only a few isolated cases for which consumption data has been published by government departments. There may be mentioned:

(1) The factory consumption of oils and fats, by the Bureau of the Census.
(2) Consumption of chemicals in the flotation of ores, by the Bureau of Mines.
(3) Consumption of chemicals in the preserving of timber, by the Department of Agriculture.

In the case of heavy chemicals, reliable estimates have been published by *Chem. & Met.* from time to time. There is room for much improvement in the collection and dissemination of statistics on consumption and it is to be hoped that the census of distribution now being planned can be rapidly developed to its maximum usefulness.

INFORMATION as to location of producing units must be assembled from various sources. These include catalogs, buyers' guides, advertisements in trade and technical journals and in miscellaneous publications. To use these sources always involves the tedious and



somewhat doubtful process of separating actual producers from the jobbers and dealers.

The Bureau of Census now publishes for individual chemicals the number of establishments by States, which supplemented by information from other sources is very valuable. In the case of dyes and synthetic organic chemicals, the annual report of the Tariff Commission gives accurate information as to the producers of each product.

Imports and exports are published regularly by the Department of Commerce in considerable detail. Monthly imports on dyes are published jointly by the Chemical Division of this department and the Tariff Commission. In addition, certain trade journals and business newspapers publish import data by ports. These data may or may not be accurate, as they are taken from the "Ship's Manifest" filed at each port. Their accuracy usually depends on the completeness of the designation on the manifest rather than the faithfulness of the compiler. They must, therefore, be used with care. In all cases the fallacy of accepting statistical data at its face value should be emphasized. The commercial researcher, in order to get the most out of such data, must be on more than a speaking acquaintance with their sources. He must take the necessary time to learn how they are compiled and whether or not they represent the whole industry. In other words, he must know his statistical sources as intimately as the technical man must know the source and reliability of the technical information he uses in his engineering calculations.

Geographic Zones of the United States

I	New England	V	South Atlantic and East South Central
II	Middle Atlantic	VI	West South Central
III	East North Central	VII	Mountain
IV	West North Central	VIII	Pacific

CONSUMPTION of a product can usually be estimated closely by an analysis of production, imports and export data available for most chemical commodities. The more important consideration of the distribution of this consumption as between industries and geographically is much more difficult to ascertain. It is here that the resourcefulness and ingenuity of the commercial researcher has ample room for full play.

Consumption of a product used as a raw material can often be obtained by applying a factor to the production statistics for the industry in which it is required. This factor, which is the ratio of raw material to finished product, can usually be determined by production practice or can be closely estimated. As an example the estimate of carbon bisulphide required by the rayon industry in 1928 is shown in Table I.

With a knowledge of the location of the various plants listed, a fair approximation of the geographical consumption of carbon bisulphide by this industry can be obtained.

DATA published by the Bureau of the Census on the output of industries by States are often useful in determining the important consuming centers for a particular product. The accompanying graphical analysis of twenty-two industries which consume chemicals illustrates how this information may be used.

Each of these industries is distributed according to eight geographical zones. These zones within the United States correspond with the main freight rate territories. While the freight rate territories do not follow state lines, it has been necessary in tabulating the data to make the geographic zones correspond with the state lines. The eight zones are shown on the attached outline map of the United States, as well as in Table II. The distribution based on the production for each industry as reported by the Bureau of the Census for 1923 and 1925 is shown in Table III on page 10.

Table I.—Estimate of Carbon Bisulphide Required by the Rayon Industry, 1928.

Company	Estimated Rayon Production 1928 in Pounds (*a*)	Carbon Bisulphide Required in Pounds (*b*)
The Viscose Company	53,000,000	26,500,000
Du Pont Rayon Company	19,000,000	9,500,000
Industrial Rayon Corporation	4,500,000	2,250,000
American Glanzstoff Corporation	250,000	125,000
American Rayon Corporation	800,000	400,000
Belamose Corporation	1,400,000	700,000
Delaware Rayon Company	1,500,000	750,000
Total	80,450,000	40,225,000

(*a*) From *Textile World*— Rayon Section, Sept. 29, 1928, P. 54.
(*b*) Based on 0.5 lb. of carbon bisulphide per pound of rayon.

Table II.—Geographic Zones in the United States Corresponding to the Principal Freight-Rate Territories.

I. New England States—Maine, Vermont, New Hampshire, Massachusetts, Connecticut and Rhode Island.
II. Middle Atlantic— New York, New Jersey, Pennsylvania, Delaware, Maryland, West Virginia and Virginia.
III. East North Central— Michigan, Ohio, Indiana and Illinois.
IV. West North Central— Wisconsin, Minnesota, North Dakota, South Dakota, Nebraska, Iowa, Kansas and Missouri.
V. South Atlantic and East South Central— North Carolina, South Carolina, Georgia, Florida, Kentucky, Tennessee, and Mississippi.
VI. West South Central— Arkansas, Louisiana, Oklahoma and Texas.
VII. Mountain— Montana, Idaho, Wyoming, Colorado, Utah, Nevada, Arizona and New Mexico.
VIII. Pacific— Washington, Oregon and California.

TRANSPORTATION as a Factor in Distribution

An Editorial Staff Interpretation

TRANSPORTATION of the products of chemical industries requires as careful attention to technical detail and as thorough an economic analysis as do the problems of production and selling. With the modern refinements of shipping containers and material handling there is practically no commodity which cannot be moved by rail or by water at the will of the producer or purchaser; but there are numerous and important regulations as to the packaging and handling of many of these commodities and there are also vital considerations of costs of transportation involved.

The rates charged by common carriers and the costs involved in the various systems of transportation are important parts of the delivered cost of the industrial product. Management does not always appreciate, however, how intimately interlocked are the rates on different commodities and for different geographic areas. The industries of the United States have worked so long and so successfully under the freight-rate systems controlled by public officials that it is easy to forget the older days when one industrial unit was often either favorably or unfavorably treated with respect to freight rates by discriminatory systems of charges which gave one competitor much lower delivery costs than another. Often such discrimination was unintentional, but in some cases it was deliberate, planned according to the then-prevailing system of favoritism for friendly shippers and handicap to competitors whom it was desired to discourage or actually destroy commercially.

PUBLIC regulation of freight rates for both railway and water transportation has done away with that form of discrimination in so far as it is an intended or an avoidable complication. But no amount of public supervision can do away with the competitive nature of freight rates. Such competition is a consequence of economic

Table III—Geographical Distribution of Industries Consuming Chemicals by Zones, United States 1923 and 1925

(See explanatory article and map on page 9)

Consuming Industry	Zones I	II	III	IV	V	VI	VII	VIII	Per Cent Total Distributed
	Percentage of Total Value of U. S. Production, 1923–25								
A. Food Products:									
1. Bread and bakery products —1923	8.9	41.1	22.3	11.4	3.6	3.3	1.7	7.5	99.8
—1925	8.4	39.8	22.5	12.1	4.2	3.8	1.8	7.5	100.1
2. Confectionery —1923	14.0	33.5	23.4	12.1	4.8	2.0	2.2	6.9	98.9
—1925	13.9	33.3	24.8	12.4	4.4	2.4	2.1	6.5	99.8
3. Flour, feed and grain mill products—1923	1.3	14.7	15.8	40.6	7.7	6.1	3.6	9.7	99.5
—1925	1.4	17.3	14.9	40.0	7.6	6.6	3.9	8.2	99.9
4. Sugar (80.6% refining) —1923	....	37.2	2.6	....	....	13.2	5.7	1.6	60.3
—1925	....	35.7	3.9	2.9	....	12.8	21.9 (a)	....	77.2
5. Beverages —1923	8.2	35.4	17.1	11.9	15.0	5.8	1.3	5.0	99.7
—1925	8.4	33.3	16.1	12.7	16.9	7.1	1.2	4.3	100.0
6. Flavoring extracts and sirups—1923	3.8	39.7	22.5	8.2	1.9	4.4	....	4.8	85.3
—1925	4.6	37.3	23.0	10.3	9.1	8.8	..	6.0	99.1
B. Textiles:									
7. Artificial leather (d) —1923	15.0	50.0	35.0	....	....	....	....	....	100.0
—1925	20.0	50.0	30.0	....	....	....	....	....	100.0
8. Dyeing and finishing —1923	47.6	41.2	2.2	3.9	3.8	....	....	0.9	99.6
—1925	40.7	43.3	2.2	0.3	4.7	....	....	0.2	91.4
9. Cotton manufacturers —1923	38.6	13.8	0.8	....	45.0	1.3	....	0.5	100.0
—1925	36.0	13.0	0.8	0.1	47.3	1.2	....	....	98.4
10. Knit Goods—1923	10.0	58.0	8.7	9.1	12.0	0.2	0.1	0.6	98.7
—1925	9.8	56.0	8.7	8.5	14.1	0.2	0.1	0.9	98.3
C. Chemicals and Allied Products:									
11. Chemicals—1923	4.1	55.1	23.8	4.0	2.7	0.4	0.3	2.3	92.7
—1925	0.6	57.4	26.4	4.4	3.0	0.6	0.5	3.0	95.9
12. Perfumery, cosmetics andtoilet preparations —1923	8.1	53.8	24.2	8.9	2.5	0.2	....	0.9	98.6
—1925	8.4	51.7	23.6	8.5	3.2	0.4	....	1.9	97.7
13. Explosives —1923	....	45.9	9.6	11.2	15.0 (est)	0.9	....	7.9	76.0
—1925	....	44.9	9.9	13.1	2.9	1.0	7.7	8.6	88.1
14. Petroleum refining —1923	....	27.6	6.1	4.1	1.4	32.3	5.4	14.9	91.8
—1925	1.5	23.1	6.8	4.3	0.5	35.7	3.7	15.6	91.2
15. Paints and varnishes—1923	3.2	42.3	36.6	7.0	2.4	0.6	0.6	5.1	97.8
—1925	2.7	42.0	36.9	8.9	2.5	0.6	0.5	4.7	98.8
16. Soap —1923	9.2	35.0	28.3	19.6	0.3	0.2	....	4.8	97.4
—1925	10.9	36.1	28.8	17.8	....	....	....	5.7	99.3
17. Baking powders and yeast —1923	....	34.1	50.0	2.9	....	....	....	4.7	91.7
—1925	....	41.6 (b)	58.4 (c)	....	....	....	....	....	100.0
18. Cleaning and polishing —1923	13.3	31.2	39.1	12.9	0.2	0.3	....	1.7	98.7
preparations —1925	15.4	32.2	40.6	6.3	0.4	0.3	0.2	2.2	97.6
D. Miscellaneous:									
19. Leather, tanned and finished —1923	16.0	50.0	15.7	10.0	5.1	....	....	2.4	99.2
—1925	15.8	49.0	14.0	10.2	1.6	....	....	2.3	92.9
20. Paper and wood pulp —1923	28.4	30.0	21.6	12.5	0.3	0.6	....	3.5	96.9
—1925	25.8	25.7	23.2	12.3	0.4	1.0	....	3.9	92.3
21. Glass —1923	....	59.5	29.8	3.9	0.3	3.8	....	1.6	98.9
—1925	....	58.0	29.7	....	....	1.9	....	2.4	92.0
22. Steel works and rolling mills—1923	1.0	51.5	40.5	1.2	3.2	....	....	0.7	97.1
—1925	....	45.6	44.1	1.1	3.5	....	....	1.0	95.3

(a) Includes zone VIII. (b) Includes zone I. (c) Includes zones IV and VIII.
(d) Distribution estimated, based on known percentages of 10.0% for zone I plus two additional establishments: of 34.0% for zone II plus two additional establishments; and two establishments in zone III.

law, no more repealable than the physical laws of gravitation, of electricity, or of other natural phenomena. The executive must, therefore, analyze existing rates and proposed changes therein in order to determine wherein his commodity or his plant location gains or suffers. He must be prepared to take advantage of such factors by readjustments of his distribution system as well as by care in the original placing of producing plants.

Similar competition, created by transportation, exists between commodities quite as actively and as irrepealably as between locations. A rate affecting lime may indirectly affect caustic soda, one fixed for chlorine certainly will influence the marketability of other bleaching agents, and the rates for one fuel or source of energy will determine the economic position of all other competitive or interchangeable fuels. And, too, the rates for raw materials and finished products are necessarily interrelated and are often the effective factor determining the most desirable location for processing of the material into its finished form. It is evident, therefore, that no narrow geographic or limited industrial view can be taken of transportation rate structures.

The freight rate charged for any given commodity between any two given points depends upon many factors other than the distance and value of the goods, which fix "what the traffic will bear." In fixing such charges the difficulty of handling, including particularly the hazards of transportation, are carefully appraised and have their bearing upon the rate. Thus commodities which must be handled with extreme care to avoid danger to life or property naturally impose transportation difficulties that account for such higher charge.

A careful study of the underlying packaging problems reveals, however, that not only the size of the shipment, but also the size and character of the individual container often are a large factor in determining the expense of handling while in transit. These considerations are obvious if one compares a 10,000-gal. tank car of petroleum with a corresponding quantity packaged in 5-gal. tins. The difference here is one of wholesale versus retail packaging. But there is also the problem of ease of loading and unloading, and necessary restrictions on car handling or car placing which accompany less effective units of shipment. And where distinctions are made of this sort it is important both in quoting delivered prices and in planning broad industrial programs to select that size and character of package which permits the minimum over-all cost in delivery.

In some cases these considerations determine the number of plants or the number of warehouses which a corporation must maintain. It is, for example, far more efficient to have the larger part of a freight haul carried out in tank-car lots, with repackaging at various centers of distribution whenever there exists a large differential between the tank-car rate and small-container rate affecting the commodity that must ultimately reach the user in the small container.

The return of empty containers is essential for the economical distribution of many commodities, such as compressed and liquefied gases which travel in high-pressure cylinders, liquids which are handled in expensive drums, and many other commodities on which the package cost is sufficient to warrant reuse of the container. When a producer of chemical products that are shipped in such containers offers his product he must quote the price on such a basis as to make clear who pays not only the out-going freight, but also the freight on the returned empty tank, drum, or other package.

Such a transaction is necessarily a round-trip-fare business. It has been likened to the summer round-trip excursion-fare activity of railroads which seek by that means greatly to increase the summer passenger business which might not otherwise be available to anyone. In the case of the excursion fares the reduced rates are often sufficient to attract business onto the line that would not be had by any carrier were there not special price inducements. So, too, in the case of freight moving in returnable containers. Unless the rate on returned empties is made attractive it is often difficult for the railroads to secure the business at all.

> The big problem in transportation today is an economic rather than a technical one. The objective is the getting of over-all low cost of delivery under existing or proposed freight rates utilizing all manner of transportation agencies that are available. Such selection is not easy nor simple. But fortunately the physical means for carrying out the transportation are readily available, whatever system is determined upon as of optimum advantage for any particular company or any particular commodity.

In the Southwestern Consolidated Rate Cars this matter of returned empty containers has proved to be a very important consideration for chemical engineering industries. There has been joint effort made by the associations of industrial alcohol manufacturers, compressed gas manufacturers, chlorine manufacturers, and manufacturing chemists to have reconsideration given to the proposed increases in rates on empty containers so that all of these industries which are vitally affected may avoid the necessity of entirely revamping their distribution practices. This case has not yet been settled, but it is evident that if it is not adjusted as requested by these manufacturing groups then there will be an entire reshaping of production, warehousing, and sales practices. A much larger percentage of the business will have to be done in bulk form from producing points to warehousing and packinging centers, and from these points new distributing methods will probably replace the railroads in large part.

MUTUALITY of interest between producer, railroad, and purchasing user actually exists, but is often not clearly recognized. Let us take for further illustration of this point one of the ramifications of the Southwestern Consolidated case just mentioned. Suppose the rate on chlorine cylinders should be changed from one-half of fourth class to full fourth class, as was proposed. This would probably at once necessitate establishment of cylinder-filling plants by the principal chlorine producers who would then move the bulk of their output from their works to the new distribution centers in tank cars rather than in smaller containers. The new warehouses would obviously be established near large centers of consumption and the distribution from them to the individual customers would take place largely by truck and to a very small extent by further rail move-

ment. The result would be a distinct lowering of the total freight bill of the industry and a corresponding reduction of gross income to the railroads.

At first glance this might appear to be an advantage to the producer and user of chlorine, but the fact is that the new system would require very large new investments in warehouses and handling plants and probably in many cases create an uneconomical business structure from which no one would gain any advantage. The delivered cost of chlorine would probably be increased, the use of chlorine would be somewhat handicapped thereby, and the railroads and the producers would both make less money.

Investigations affecting this case have not gone far enough to prove that the present rate on empty chlorine cylinders is the proper one or to indicate whether that rate should be higher, as the railroads propose, or perhaps lower than at present. The case is, however, an excellent one with which to illustrate the complexity of the problem and the necessity for co-operative study by all interested parties, including the transportation agencies of the country. The example cited for chlorine is not peculiar to that commodity or to the compressed gas industry. An identical problem exists in the case of every commodity which moves in a returnable container and which can be handled either in bulk or in small containers at the will of the shipper or the consumer of the product.

PLANT LOCATION must always be considered in the light of its relation to both raw materials sources and product markets. It is obvious that a bulky low-price commodity like lime would not under ordinary circumstances be hauled great distances. Hence, there have grown up in the United States many and widely scattered lime plants. And yet this particular industry illustrates also the fact that where a product has some peculiar or special quality advantage it may travel great distances, even with apparent cross-hauling of commodity. There are, for example, certain kinds of lime used for particular chemical and industrial purposes that do so move and can successfully compete in areas remote from the producing point.

With the intensive inter-industry as well as inter-company competition of today certain concerns have found their principal handicap in faulty plant locations. In the establishment of new industries such difficulties are, of course, more or less readily avoidable; but in the case of an old and well established business there is always the question of the relative disadvantage of abandoning an old investment to erect a plant in a new location as compared with the current difficulty experienced with the existing distribution structure. Management would welcome some magic by which it could solve this difficult problem. Upon its settlement often depends the prospect of future dividends.

COMPETITIVE means of transportation exist in many cases. There is always the problem of determining the proportion of freight movement to be accomplished by truck and that which must be done by rail. Often water transportation enters with attractively low rates, especially for the commodity that is of low unit cost which will permit slow movement and longer maintained investment in finished product. Changes in freight rates often change the rail and water relations. In one important electro-chemical industry an increase in long-distance railway rates resulted in large water movement from the Eastern Seaboa. through the Panama Canal to the Pacific Coast. This movement was so great and has continued so effectively that the railways have never fully recovered the business; and furthermore, there has been found very little excuse for establishing of new producing units on the Pacific Coast for this commodity.

SAFETY in transportation is of prime importance to all branches of the chemical engineering industries. These industries have had before them the most difficult technical problems because in general they are the producers of all of the explosives and dangerous commodities which move by rail or water. It is a matter of congratulation that the work done by the manufacturing interests of the country has been so effective that there is today almost no restriction imposed upon the handling of such dangerous commodities except those which logically affect the containers and the labeling of containers. A negligible percentage of the hazards of industrial transportation originate in the dangerous character of the commodities, so well are these handled as a result of the joint efforts of the railways, public officials, and industrial shippers.

This commendable situation has, however, not come to pass without extensive and intensive work. Many thousands of dollars have been spent by various companies in the developing of cylinders, drums, tanks, and other container units suitable for the handling of various commodities. This work has been guided by and been done in co-operation with the Bureau of Explosives of the American Railway Association and with the cordial encouragement of the Interstate Commerce Commission. Some recent examples of successful packaging development need only be mentioned to bring out the importance of the container in safe transportation.

NEW COMMODITIES have repeatedly introduced new transportation problems. The handling of large quantities of compressed and liquefied gases has for a long time been handicapped by the attempt to use only the ordinary size cylinders which have for many years been accepted for rail transportation. It was a logical development from these smaller containers that attempt should be made to use larger units. Such unit containers were successfully developed and the multiple-unit tank car resulted. Development did not stop there, and within the last two or three years there have been authorized several new types of tank cars of exceptionally large size.

Such tank cars have, however, not been accepted without very careful investigation of their merits and their safety. The character of the tank and method of its construction are fully specified. Filling, emptying, and safety blow-off devices are all prescribed; man-hole construction is given in detail; heavy thermal insulation with outer steel jacketing for mechanical protection is included. In order to insure that such transportation units are kept in order, appropriate retesting at pressures from one and one-half to three times the maximum working pressure limits is prescribed by official rules and carefully carried out by owner companies. As a result the tank cars in which one can ship liquid ammonia, liquid chlorine, liquid propane, and high-pressure helium are all as safe as are a like number of cars hauling heavy crude oil, tar, or sulphuric acid. As a result of the thoroughness and technical skill with which transportation containers have been developed there appear to be almost no serious problems remaining in this field.

The TARIFF as a Factor in Chemical Industry

STUDY of the total imports of chemicals and related products under the various tariff acts that have been in effect since 1900 reveals a number of interesting relations. For example, there is the apparently anonymous situation that imports have increased during periods of high tariff. The ratio of dutiable imports to those that enter free of duty has fallen from about 1:1 in 1900 to 1:3 in 1927. The average tariff level as represented by the ratio of the total duty collected to the total value of dutiable imports was approximately constant during the first twenty years of this period, but rose markedly in 1920 and during the last five years appears to have settled at an equivalent ad valorem rate of about 35 per cent.

The statistics on which these comments are based were compiled for *Chem. & Met.* by E. T. Dunn of the Chemical Division of the United States Tariff Commission. As indicated in the table, they are based primarily on the so-called "Group 8. Chemicals and Related Products" classification of the U. S. Department of Commerce as used in the 1926 edition of *Foreign Commerce and Navigation of the United States.* This classification includes the following: Coal-tar chemicals (crudes, intermediates, dyes and other finished products), medicinals and pharmaceutical preparations, acids and acid anhydrides, ammonium compounds (except fertilizers), barium compounds, calcium compounds (acetate and chloride), potassium compounds (except fertilizers), sodium compounds (except fertilizers), other chemicals, paints, pigments, varnishes (mineral pigments, chemical pigments, paints, stains, enamels), fertilizers and fertilizer materials (nitrogenous, phosphate, potash and others), explosives, ammunition, pyrotechnics, soaps, perfumery, cosmetics, toilet preparations, collodion, blacking and polishes. In this table pyroxylin (nitrocellulose) products are also included although they are not a part of Group 8. It should also be pointed out that these statistics do not correspond entirely with the tariff classifications in Schedule I, Chemicals, Oils and Paints, of the Tariff Act of 1922. The principal exceptions are that vegetable and essential oils, botanical drugs and dyeing and tanning materials (including crude products and extracts) are not included in the *Chem. & Met.* compilation. The effect of these additional classifications would be to lower slightly the calculated equivalent ad valorem duty.

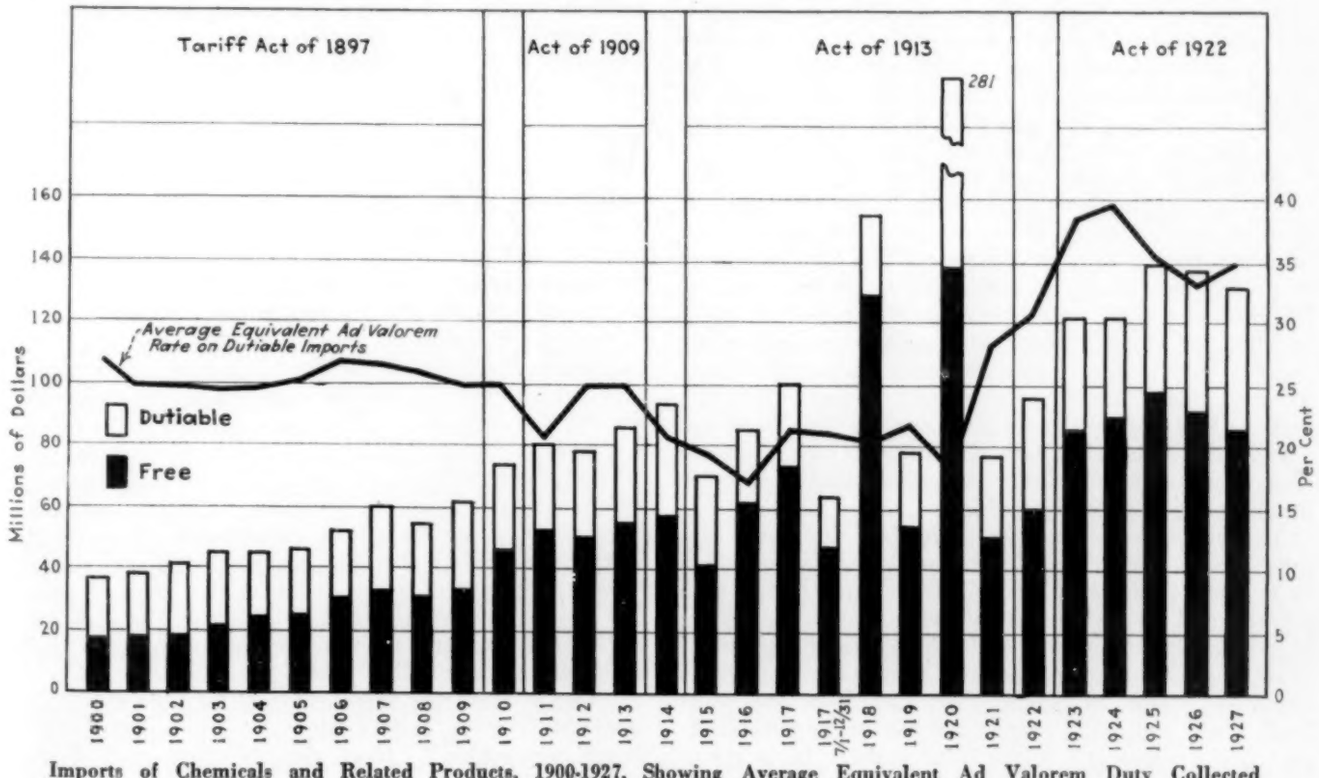
Table I.—Imports for Consumption of Chemicals and Related Products, 1900 to 1927

($000 omitted)

Source: *Foreign Commerce and Navigation of the United States*

Year	Value of Imports: Dutiable Chemicals	Value of Imports: Duty-Free Chemicals	Value of Imports: Total	Duty Collected	Ratio in Percentage of Duty to Imports of: Dutiable Chemicals	Ratio in Percentage of Duty to Imports of: All Chemicals
1900*	20,660	17,214	37,874	5,678	27.48	14.99
1901	19,792	18,905	38,697	4,925	24.88	12.73
1902	22,173	18,752	40,925	5,420	24.44	13.24
1903	23,355	21,971	45,326	5,716	24.47	12.61
1904	21,450	24,006	45,456	5,362	25.00	11.80
1905	21,063	25,789	46,852	5,395	25.61	11.51
1906	22,951	30,808	53,759	6,212	27.07	11.56
1907	27,130	33,730	60,860	7,213	26.59	11.85
1908	25,033	30,534	55,567	6,529	26.08	11.75
1909	27,734	33,310	61,044	7,018	25.30	11.50
1910	26,712	46,361	73,073	6,820	25.53	9.33
1911	28,471	51,669	80,140	6,126	21.52	7.64
1912	28,423	50,144	78,567	7,239	25.47	9.21
1913	30,823	55,527	86,350	7,907	25.65	9.16
1914	35,035	58,871	93,906	7,528	21.49	8.02
1915	28,427	41,865	70,292	5,700	20.05	8.11
1916	24,255	61,459	85,714	4,291	17.69	5.01
1917	27,703	73,290	100,993	6,073	21.92	6.01
1917**	14,018	48,249	62,267	3,053	21.78	4.90
1918	24,106	129,202	153,308	5,167	21.43	3.37
1919	26,330	53,279	79,609	5,915	22.46	7.43
1920	42,522	138,440	280,962	8,081	19.00	2.88
1921	27,356	50,137	77,493	7,927	28.98	10.23
1922	37,263	60,450	97,713	11,633	31.22	11.91
1923	35,292	86,617	121,909	13,677	38.75	11.22
1924	32,131	89,375	121,506	12,855	40.00	10.58
1925	41,297	98,573	139,870	14,958	36.22	10.69
1926	45,607	91,889	137,497	15,478	33.94	11.26
1927	44,934	86,081	131,015	15,837	35.25	12.09

*Fiscal years up to 1917 inclusive.
**July 1-Dec. 31.
"Chemicals" as classified in Group 8 in 1926 Commerce and Navigation, is basis of classification with the exception of pyroxylin products which are included in this table.



Imports of Chemicals and Related Products, 1900-1927, Showing Average Equivalent Ad Valorem Duty Collected Under Various Tariff Acts

How the INVESTMENT BANKER Looks at Chemical Industry

By William R. Basset
General Partner, Spencer Trask & Company
New York

Industrial engineering and corporation finance have been the two chief interests of Mr. Basset throughout an unusual business career. For sixteen years previous to his present connection he was president of Miller, Franklin, Basset & Company, specialists in industrial engineering and accounting. In 1917 he was called by the government to supervise artillery ammunition production, and later to educate other munition manufacturers to more efficient production methods. In 1928 he was admitted as general partner in Spencer Trask & Company, whose interests have included many chemical properties.

BANKERS, in spite of the conservatism which is an essential characteristic of their profession, have been led by the great business changes in recent years to change considerably the tests which they apply to any enterprise. They have quickly and willingly adapted themselves to the new order. They lay less stress on certain factors than before, while at the same time they demand detailed information on subjects they formerly all but ignored and in some respects they have lowered bars which once were almost unsurmountable. Again, the new requirements sometimes disqualify old-established, conservative concerns which formerly would have been attractive to bankers. The progressive business man welcomes the new attitude of the banker for, perhaps somewhat to his surprise, he now finds that the banker "speaks his language."

So long as concerns went along year after year using much the same methods as had been in use for a generation or more, certain fairly cut-and-dried tests of an arbitrary nature were satisfactory. The banker wanted to be satisfied chiefly on two points: that the company had earned a satisfactory profit over a period of years and that the tangible assets were sufficient to protect the security holders in case the unforeseen happened. It was assumed that a history of consistent profits in the past was the best assurance of future profits. But there was always the underlying fear that it might sometimes be necessary to sell the assets as unredeemed pledges in order to protect security holders.

Today the investment banker realizes that past earnings are no longer even a reasonably safe indication as to what future earnings will be. Furthermore, with markets and production methods changing so rapidly, he knows that impressive and still valuable accumulations of inventory and of bricks and mortar may turn out to be liabilities instead of assets. So, while the investment banker still accords a proper amount of importance to past performance and to the balance sheet, he is apt to dig most deeply into the prospects of future earnings.

To peer into the future, with the past a not wholly reliable guide, may seem to call for almost supernatural powers of prophecy. As a matter of fact, in many respects the fundamental trends are perfectly apparent. With mass production and its companion, mass distribution, here to stay, each year sees more concerns forced by competition to adopt mass methods, while many of those which are already on a mass basis continue to perfect and refine their methods, thus making the garnering of profits still more difficult for their less progressive competitors. Only two or three years ago, an old-established, well-thought-of-concern with a satisfactory balance sheet and a history of good earnings was turned down by a banking firm because industrial engineers reported that its manufacturing methods and much of its equipment were obsolete, while the concern's principal competitor was rapidly putting low cost production methods into use. Within a year the applicant for financing found it could no longer compete. Its scientifically organized competitor was selling some products for less than it cost the other to make them.

WHILE there are perhaps exceptions, as a rule bankers are not particularly interested in a concern which seems to have reached about its limit of growth. They prefer one which holds the promise of increased earnings and they realize that under modern conditions the sound way to get larger earnings is by getting a large volume of business at a reasonable profit rather than by increasing the margin of profit. So about the first thing the banker looks into is the concern's potential market.

But the banker realizes that today there is a close relationship between sales and production. He looks favorably upon a concern which is constantly seeking for better manufacturing methods—especially for those methods which reduce manufacturing costs. It is not only that he wants a wider margin of profit secured but chiefly because he realizes that the competition of the future is to a large extent going to be on the basis of price. The concern whose outlook is brightest will be that concern which can maintain a satisfactory margin of profit while quoting low selling prices.

I realize that that statement will be objected to by some: it is more fashionable to decry so-called "cut-throat competition." Much time is worse than wasted by business men who try to figure out means by which

prices may legally be raised or maintained at too high a level. They forget seemingly that for most products, especially staples, the best possible sales argument is low price, quality considered, and also that the surest way to large total profits is to induce large volume sales through low prices, made possible in turn by low costs and low profits per unit of sale.

I do not mean to imply that I favor striving for volume of sales regardless of profit. On the contrary, I have many times urged manufacturers to analyze their sales in order to determine which products and which markets are most profitable. More than once I have induced a client to make fewer products and to eliminate certain territories even though his volume of sales suffered. Without exception, the concerns which adopted that plan made greater total profits on the smaller volume. It is quite usual to find that the satisfactory profits made on certain products and in certain territories are eaten up by the net losses suffered in trying to sell a hard-to-sell product or to cultivate a hard-to-sell territory.

BANKERS will certainly scrutinize the selling methods of the chemical manufacturer and will be favorably impressed if they find that scientific efforts are being made to find and develop new markets and to keep the selling expense as low as possible. In general, the banker does not like to see a large part of the selling price absorbed by selling expense, for he feels that usually a high selling expense indicates that there is something unsound somewhere which makes expensive high pressure selling necessary. Too often a high selling expense is caused by the short-sighted attempt to sell the product at too high a price, when if the price were reduced to the point where customers would buy freely, the costs of selling would fall and total net profits would be greater.

Bankers are generally convinced that improvements in selling methods have not kept pace with the improvements in production methods—that they are in general quite inefficient and that, therefore, a great field for cost reduction exists.

When I advocate setting a low price as the surest and usually the cheapest way to make sales, I am not advocating selling at a loss. My point is that factory methods should be used which will make costs so low that a profit will result even at a low selling price. So important are low costs that the banker is nearly certain to send industrial engineers into a plant to report on the production methods in use and to compare those methods with the methods which competitors are using.

OF ALMOST equal importance is the attitude of the management toward betterments. Some are inclined to make a great splurge, achieve notable results in reducing costs and then sit back complacently in the conviction that no further betterments are possible. These concerns are most attractive which wage unceasing war on waste.

The banker also is interested in knowing whether a concern is equipped with a modern and adequate cost accounting system. It is not merely that lacking such a system the concern may fool itself into believing that it is securing a proper profit margin—although cost knowledge is, of course, important in setting selling prices. However, in some businesses, it is often necessary or at least advisable to sell below cost for a while. In that event, it is the part of wisdom to know accurately just what those transactions are costing.

The modern cost system is perhaps most valuable in a way wholly unconnected with the setting of selling prices. That is in comparing current actual costs with the ideal standards. In that way, any inefficiency or poor method that may have crept in is spotted before it has had time to make serious inroads into profits. A cost system properly devised and intelligently used can be highly effective in indicating better production methods.

Finally, of course, the success of any business depends largely upon the ability of the management. The points I have already mentioned indicate its ability to some extent, especially so far as the progressiveness of the executives is concerned. But that investigation can well go farther: it can include a study of the important executive decisions which have been made over a period of a few years to determine what percentage of them have proved to be correct in the light of results.

In the case of one concern in a branch of the chemical industry, the refinancing of which our company handled, we studied some thirty important executive decisions and found that twenty-seven of them had proved to be wise. In one case, the decision had been counter to the general opinion of most of the leaders in that branch of the industry, yet it had been correct and the judgment of competitors wrong. Such a record of proved good judgment was most impressive to the bankers.

In appraising the future prospects of a concern in the chemical industry, bankers will certainly be influenced by the amount and scope of the research work done. They realize that especially in the chemical industry there is always the chance that out of the laboratory may come some revolutionary discovery which may affect a business or a whole branch of the industry for better or for worse. Thinking of Duco, Bakelite and other synthetic products, he is impressed with the possibility of enhanced earnings from expanded markets and from entirely new products. Contemplating the discovery of the process for producing synthetic methanol, he realizes that in the chemical industry there is always the possibility that revolutionary changes of method may be the making of a progressive concern and at the same time the breaking of its less progressive competitors.

HENCE the banker looks with great favor upon well organized, adequate research, because of the likelihood that it will develop lower cost processes and because of the chance that the concern in which he is interested may develop new products which will better serve some present need or on which perhaps some entirely new industry may be based.

It is partly because of the greater ability of the large organization to afford ample research work that the banker looks so favorably upon combinations in the chemical industry. There are many other advantages accruing especially to soundly conceived and organized combinations of the so-called vertical type, in which the finished product of one member company is one of the raw materials of another. The diversification of products tends to add stability to earnings. There is greater opportunity to utilize by-products to advantage, there is better control of essential materials and usually marketing problems of certain units are much simplified.

It is, of course, out of the question in so short a paper to cover in detail all of the points about which a banker would ask when contemplating a piece of financing in the chemical industry. In brief, as I have said, he wants to know anything that will throw light on the probable future earnings of a concern. Other things being satisfactory, the best future awaits the concern with the most progressive, far-seeing and open-minded management.

FOREIGN MARKETING METHODS

And Their Lessons for American Chemical Industry

By Julius Klein

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Dr. Klein needs no introduction to *Chem. & Met.* readers—nor to any other American audience. His keen observations on economic and industrial developments in foreign countries and his active administration of the most important of the bureaus of the Department of Commerce, have brought him to the forefront of American economists. Born in San Jose, Calif., in 1886, educated at the University of California with graduate work at Harvard, Berlin and the Sorbonne, Dr. Klein served many years as an American representative in Europe and Latin-American countries.

UNQUESTIONABLY this is an era of big business in the broadest and best sense of the term. Typical of this movement is the merger in this country of a number of like interests or of dissimilar interests which may have a common objective—in other words, perpendicular and lateral combinations of industry. In Europe the development has been clothed in the oft-used but not so well understood term, cartel, and the so-called cartels have not only been national but they have been international as well.

Any study of present European merchandising methods and tendencies in commerce and industry must take into account what has been and is happening in the chemical industry because therein has progressed to the greatest extent and with the greatest acceleration the movement toward combinations. The chemical industry seems to be particularly adapted to such manipulation and form of treatment, largely because of its inherent characteristics.

The chemical industry is basic to all industry, science is fundamental in the chemical industry and, since science recognizes no boundaries, the industry itself is inevitably international. Furthermore, patent considerations are of the utmost consequence and operate as an important factor in this whole situation.

A historical résumé of the chemical industry would naturally and quite logically place considerable emphasis upon its development in Germany, which is second to the United States in chemical production. The Germans quickly realized and fully appreciated the great part that chemistry and the industries arising from this science were to play in the political and economic development of the world. They therefore set themselves deliberately to foster the pure science and to develop and take full advantage of its application in the organization of their national life.

Rationalization has been the basic theme in Germany and developments have been along the generally accepted lines of simplification and standardization. Smaller organizations consequently have been merged into larger ones and this fusion process has eventuated in the great German Interessen-Gemeinschaft, briefly known as the I.G.—today the greatest single business entity in Germany.

The scientist is prone to believe that he is the important element in any picture portraying the chemical industry; the manufacturer also feels that he has an inalienable right to his "place in the sun." But the question quite naturally arises: "What is the use of discovering products or processes, or of manufacturing commodities if these are not placed in distribution, merchandised, sold and consumed for the benefit of mankind in general?" Germany, therefore, in developing its chemical industry has come, particularly of late years, to recognize the necessity of skillful merchandising. The progressive steps taken during the past few years have varied from preceding years largely in the field of merchandising.

Following the war it was realized by such countries as Great Britain, France, Italy and others that a well-developed and self-contained chemical industry was essential to the national life of a people, both from the standpoint of protection in time of war and of economic progress and well-being in time of peace.

In Great Britain there has been for some time a substantial chemical industry. Within recent years it has made great progress and today probably ranks second to the German chemical industry. The history of the absorption of smaller firms by larger ones, the amalgamation of one organization with another, the fusion of all these into a single unit, and finally an international sales policy are all factors which in large measure reflect what has been taking place in Germany. We have today in Great Britain the great Imperial Chemical Industries, Limited, the commonly known I.C.I., which, from an international standpoint at least, is to all intents and purposes the British chemical industry.

The Kuhlmann development in France has been along similar lines of merger and concentration, and similar trends with like results are readily evident in Italy, Switzerland and Belgium.

News of European cartels is appearing constantly in the press. They arouse expectation or excite alarm. Their activities expand, ramify, are strengthened or redirected. New industries are swept within the scope of the idea. The commercial and industrial relations of a continent, possibly of the world, seem in process of readjustment.

We must, therefore, recognize that there have been developed in the countries of Europe powerful organizations which we must grant, for purposes of discussion at least, are as well equipped to manufacture competitive articles as we are. A consideration of the situation and the lesson to be drawn therefrom resolves itself, therefore, into a study of cartels and their operation.

What are these European cartels like? What are they trying to do? In what way and to what extent will they influence American business? These are questions of vital concern to us, if for no other reason than the fact that those of our industries, the chemical industry and others included, which would be directly affected by competition from European cartels have an annual output valued at more than $5,000,000,000.

Every cartel is, of course, a trade or industrial combination. Originally these were domestic, that is, their members in each case were all of the same nationality, but now there has appeared the international cartel, grouping the makers of a common product or closely allied group of products who operate in various countries. About a dozen such combinations are now active with centralized sales or control agencies, to say nothing of a hundred looser pooling agreements. These international cartels have as a rule been formed under German leadership.

Cartels concern themselves with such matters as control of prices, market territories, sales terms, credit policies, standardization, grading, interchange of patents among members, and so forth. The fact is, though, that probably no single cartel tries to cover this whole field of activity; most of them concentrate on certain phases of the marketing of their special product.

RIGHT after the War intense competition was in evidence, with reckless price slashing. Europeans felt that such conditions threatened to ruin their industries. A general conviction arose on the continent that understandings, "ententes," were desirable. It was felt that united effort would bring better results to European interests than a wearing-down process of unrestrained commercial strife. The main object of the typical international cartel is to control competition and thus avert attempts by the producers of any nation to indulge in unwarranted price cutting or to encroach on the logical selling territories of other countries. Limitation of production, by assigning definite quotas to the different producing countries, is one of its principal functions. Thus, in the continental view, overproduction is obviated, or at least controlled within certain relatively harmless channels. Agreements as to division of markets form another aspect of such organizations. Some of the combinations go to the extent of fixing prices, thus achieving an even more direct and effective restraint.

One of the results of the European international cartels, however, may conceivably prove beneficial to us. That result is the stabilizing of "world market prices" for the commodities involved. The cartels aim to bring prices to a satisfactory level and to keep them there. Under such circumstances the American exporter may, in certain lines, be able to compete more readily in the foreign field.

In general, we have good reason to be keenly interested in the development of these cartels and it is not unnatural that in many cases they should excite rather acute anxiety on the part of the affected industries, in this country the chemical industry particularly. There is no doubt that their operations should be closely studied and immediately reported by competent observers, so that our industrial interests may be safeguarded to the fullest possible extent.

IN ANY discussion of foreign or domestic trade and the merchandising methods involved therein, particularly from the standpoint of the United States, or in any review of the great economic tendencies which may influence manufacturing and merchandising in the future, we must give due attention to the monopoly as well as to the cartel. Foreign monopoly control of essential raw materials which this country needs and must obtain from abroad has been, and still is, a real issue although the menace formerly involved in some of these monopoly situations has been greatly tempered or entirely removed.

Because of these monopolies we have been, and still are in a number of cases, threatened in securing raw materials which we need for processing into manufactured commodities to supply our own people and to offer for sale in the markets of the world. If certain artificial and unnatural restrictions are involved at the source this country is placed at a disadvantage in obtaining its essential raw materials and in merchandising the products which result therefrom in competition with other and more favored nations.

The most important of the foreign monopoly controls of essential raw materials was that exercised in rubber, and the failure of this scheme of restriction is now a matter of history. Attempts to set up control of sisal have been met through legal proceedings and in a number of other ways efforts to artificially control essential commodities, some of a chemical character, have failed.

The application of the science of chemistry through the development of synthetic substitutes has been an effective antidote in the case of other controls, an example of which is nitrogen. We find as time passes that these arbitrary and unnatural monopolies seem to breed within themselves that which ultimately results in their undoing. The United States has made its position plain in matters of this kind and it is to be anticipated that there will be much less annoyance to our manufacturers and consumers in the future from such situations.

A brief review of several of the monopoly controls affecting the chemical industry shows that there are six major chemical products in the monopoly category: nitrate of soda; fertilizer potash; quinine; camphor; menthol; iodine. These products have constituted one-third of the value of all chemical imports.

THE Department of Commerce has done nothing directly at the source to curb the activities of foreign monopoly control of chemical raw materials. In a general way, its procedure has been of an educational character designed not only to awaken the American consumer to the danger involved, but likewise to stimulate domestic production when feasible or to foster the evolution of synthetics or the use of substitutes.

The lesson to be learned in the case of nitrate of soda rests in the fact that the production of the substitute

by-product, ammonium sulphate, is today as great as our imports. In addition, production of the synthetic nitrogen is now equivalent to one-third of our imports, and in two or three years will be equal or greater than imports of competitive nitrogen products from countries other than Chile, amounting to about one-fourth of the imports of sodium nitrate. Furthermore, the price today through this competition and despite a doubling in our consumption is about 15 per cent less than seven years ago. Chile's contribution is on the decline not alone so far as the United States is concerned but throughout the world. Today the former monopoly is faced with a fight for its very existence.

In the case of fertilizer potash, consumption has not grown since the pre-war period, nor has the price changed. It has been felt, however, that the control prior to 1913 had established an artificial price and consequently the Department has worked to prevent any further advance. Fortunately the foreign suppliers of potash realize that it is to their advantage to maintain an unrestricted supply of this essential material at a reasonable price.

Quinine has been the subject of litigation and, through this means and in other ways yet to be worked out, it is believed that the methods of merchandising heretofore in effect, which have been so obnoxious to the United States, will be modified for the benefit of American consumers.

Today synthetic camphor and menthol have removed any danger of unfair treatment by foreign suppliers of the natural products, and the monopolies which have been set up in these commodities are facing the disastrous end which it is believed is foreordained for such methods of merchandising.

The American chemical industry is today, in point of absolute volume, the greatest in the world in the value of manufacture, import and export. The industry has increased its output 50 per cent during the past six years. In 1921 the total chemical production according to figures furnished by the Bureau of Census was $1,600,000,000, while the figures for 1927 are estimated as approximating $2,500,000,000. Our foreign trade in chemicals has increased, exports from the United States having grown from $123,000,000 in 1922 to approximately $200,000,000 in 1927. These figures in themselves are sufficiently interesting to arrest attention but they take on a great deal more significance when it is realized that in place of the raw materials which were shipped in the past, exports of chemical products now consist in major part of finished and otherwise highly fabricated commodities. The converse of this is true with regard to our imports of chemical products which today are in large measure raw materials brought in for subsequent processing. Imports in 1922 amounted to $165,000,000, while in 1927 they approximated $200,000,000. From a very low ebb six or seven years ago the American chemical industry has advanced to the point where today it is enjoying an extraordinary period of prosperity.

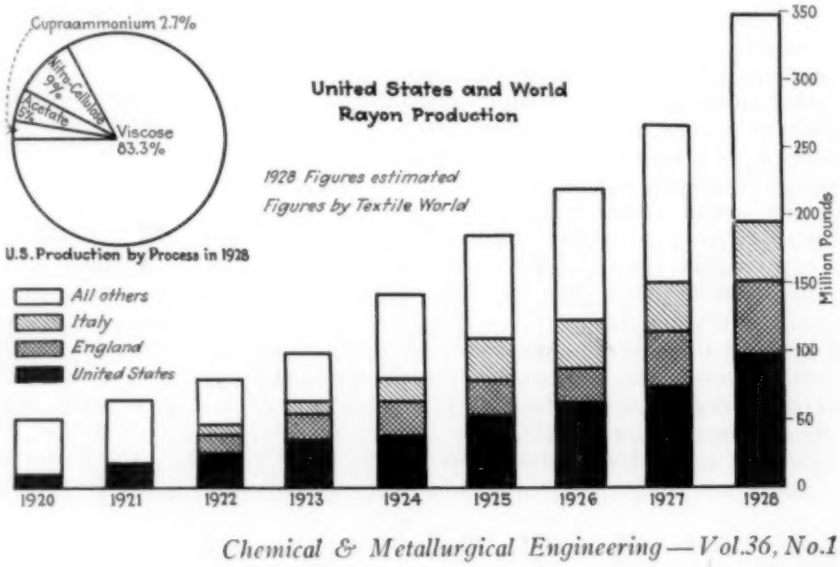
In summing up, therefore, it may be said that the European idea is that of community action. Merchandising methods have therefore been built up by industry with this as the underlying theme. In the United States, however, there exist the more virile forms of merchandising arising from our American individualism which is in essence the direct antithesis of the European conception. In spite of the one and, we believe it fair to say, because of the other, our American chemical industry has advanced to its present pre-eminent position. Cartels may be suited to European conditions but they are not necessarily practical here. What they may have achieved in price stability is, after all, to our gain. We can accomplish many of their objectives through typically American methods. As to foreign monopoly controls, we have demonstrated their futility. Some have collapsed simply under the light of intelligent inquiry.

If any branch of American industry, even though inherently a natural monopoly, ever feels that government aid and control are needed, it has its lesson in the experience of these foreign controls. It is safe to say that with the lessons of the past before us and with a steadfast continuance of the ideals which we have so consistently followed heretofore the stability and prosperity of the American industry are assured.

Rayon Persists in New Gains

INCREASE in the domestic rayon production since 1920 has been phenomenal, but the rate of expansion in foreign countries has been even more rapid, although the United States remains the leading producer. An increase of over 30 per cent in the domestic output of rayon during 1928, as compared with 1927, is estimated, and at the same time, a further increase of 30 per cent is indicated for 1929, as against 1928. The consumption of rayon this year is estimated to have been about 20 per cent greater than last year.

During the first half of the year just ended, rayon manufacturers found it harder going than in 1927 and there were times when the retailers found it difficult to dispose of their stock. Nevertheless, it is apparent from reports coming from all sections of the country that the greater part of the domestic consumption has been absorbed, that the importation of rayon while still large was somewhat less than in 1927 and at present there is no indication of over-production or early necessity of price cutting. Below is given a graphic representation of the past nine years' developments.



UNITED STATES—The Leading Factor in World Chemical Industry

By T. W. Delahanty

Assistant Chief, Chemical Division
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Washington, D. C.

Graduating in chemistry from Cornell University in 1917, Mr. Delahanty first applied his chemical knowledge in the trading departments of several chemical firms. He served a short time as inspector of powder and explosives for the United States Ordnance Department, but at the close of the war was a lieutenant in the Air Service of the United States Navy. Since joining the Chemical Division, Mr. Delahanty has distinguished himself and his organization through a series of able reports on chemical industries of this country and abroad.

BASED on an estimation of qualified representatives of the major chemical producing countries of the world, rendered at the International Economic Conference in May, 1927, the United States was acknowledged as the largest factor in chemicals, accounting for approximately one half the world's production.

Of course it is practically impossible to define what might be termed the Chemical Industry, for the line of demarcation is virtually undeterminable on the side of raw materials and similarly with regard to finished products. This is particularly true in the major chemical producing countries where the industry merges into or overlaps the agricultural and mineral phases on the one hand and where, on the other, chemical producers are extensively engaged in the still higher utilization of their basic products for specialized materials. The appraisal of the conference, therefore, is based upon an arbitrary grouping in general comprising heavy or industrial chemicals, fertilizers, paint products, organic derivatives, medicinal and toilet preparations and a certain number of generally accepted natural products or derivatives of animal, mineral and vegetable origin, such as glue, pigments, naval stores, and the like. Despite the protest of Great Britain, it does not include certain minerals and metals, glass and refractories, cellulose and rubber products, coke and fuel gases, animal, mineral and vegetable oils, rayon and artificial leather, nor even the items sugar, starch, salt, soap, flavoring extracts, and a host of common industrial products decidedly chemical in character, origin or processing. Also it does not embrace the contributions of chemical processing industries whose service, even though performed as a distinct operation, must ultimately form a part of the enhanced value of the product treated. Such is the case in the industries of bleaching, printing and dyeing, galvanizing and plating, tanning, refining, and many others. Where may we stop? As chemical processing is basic to all industry we must of necessity be arbitrary. Such has been the reaction of the estimators who indicate that the field as arbitrarily defined accounts for an annual world production of approximately five billion dollars, of which that of the United States is in the neighborhood of two and a half billion dollars, three-fourths of the balance being accounted for by Germany, the United Kingdom, France and Italy.

Of the world's chemical production, about one billion dollars' worth enters foreign trade. Germany, the United Kingdom, France and the United States cater to $\frac{2}{3}$ of this foreign trade demand. The United States contributes but $\frac{1}{12}$ of its production, whereas the others look to outlets in other countries to absorb about $\frac{1}{3}$ of their production of chemicals. However, such a comparison of accomplishment, wherein the foreign export-production ratio is 4 times that of the United States is not a true reflection, for were we in fairness to discount the trade of European countries one with another we would find that these producers in the aggregate export less than $\frac{1}{10}$ of their production outside of Europe and their closely protected or preference trading possessions. Their combined exports to the world outside amount to about $170,000,000 in contrast to the $200,000,000 approximately attained by the chemical exporters of the United States. Furthermore, the total sales of these European producers to the United States amount to about $90,000,000 and they in turn take from us over $70,000,000 worth of chemicals annually. In brief, Europe relies upon the United States as a market for over $\frac{1}{2}$ of its export of chemicals, whereas the American producers in turn look to Europe to take about $\frac{1}{3}$ of their export. It follows from the foregoing that the United States must inevitably be recognized throughout the world as the largest exporter as well as producer of chemicals.

Finally, the United States is likewise the largest importer of chemicals,—practically equal in value to our exports, and equivalent to $\frac{1}{10}$ of our production. Though endowed with raw material resources second to none, the fact that over $\frac{2}{3}$ of our chemical imports consist of exotics or supplements to our raw material supply is a further tribute to the scope of our development. Furthermore, the absence of many of these exotic essentials has, particularly in recent years, been an incentive for synthesis and a boon to research designed toward the utilization of what might formerly be termed uneconomic resources. The stage of progress has now been

reached where few, if any, of the exotics may not in time of necessity be replaced by synthetics or substitutes.

Formerly it was considered axiomatic that the development of a chemical industry in any country was dependent upon the supply of raw materials available within its own territory and the extent and availability of financial, scientific, technical and labor resources. Daily it is becoming more evident, however, that raw materials and resources irrespective of origin, seek world demand, and even though initially monopolistic or restricted, are ultimately forced to yield to economic conditions. In the final analysis, it is now recognized by all countries that, based upon what has been demonstrated by the United States in the past six years, the size and extent of a chemical industry is primarily dependent upon a large consuming home market, with a well developed standard of living, assured, protected and fostered by the public, on the principle that the independence of such an industry holds forth the promise of independence and leadership for the consuming branches of industry in general. In fact, as long as the principle of fostering American industry is prevalent, we need no longer fear even the advent of revolutionary developments abroad.

This comparison of facts and figures should have a very important bearing in considering the probable effect upon American industry and trade of such alliances as are in effect or in prospect on the Continent. It has been intimated by the participants that such accords are designed to bring European producers closer together, to facilitate the interchange of raw materials and finished products—in brief a "United States of Europe." Assuming this to be the case, were we to superimpose the European producing area, major and minor, exclusive of Russia, upon a map of the "United States of America" and incorporate in our picture the relative commodity production, and export and import accomplishments of both Continents, we would find that the American industry held a decided advantage in raw materials, production and trade. In addition by virtue of our high wages and standard of living, the comparison is particularly in our favor from a consuming standpoint considering that the population of that portion of Europe is three times that of the United States.

If the tendency, therefore, is toward Continental nationalization of the chemical industry, success would seem assured through a uniform policy designed to raise the consumption to a level comparable with that of the United States. If this is in prospect, such development should so enhance European costs as to ultimately remove them as a comparative menace to the United States in world markets. Incidentally, it should open up the possibility for an even greater participation by the United States in the expansion of Europe's per capita consumption. It is doubtful, therefore, if these producers would invite or even be receptive to the United States being a party to such an accord. Initially, in any case, there would be no inducement they could hold forth to the United States industry which might compensate for the decided advantage we already enjoy abroad, and most certainly a per capita consumption at home over three times that of the Continent is a prize which our industry would jealously guard. As a matter of fact, there would seem to be no inducement even for the United Kingdom to be a party to such an accord, for the producers of that country have a greater potential development through dominion accord and preference, since in the aggregate areas are involved which are rapidly developing, whose standards are following our own and whose initiative is strikingly characteristic of our country.

As to the future of the American chemical industry, a mathematical projection of our expansion in the past quarter of a century indicates that we should again double our production in the next decade. As to saturation, however, it is difficult for one who appreciates that "chemicals and the science are basic to all industry" to define its expansion limit. As our natural raw material is exhausted the field of chemical production grows; as refinements in living progress it grows; as specialization of industry continues it grows. It may also be said that the industry is constantly engaged in dissolving the line of demarcation between necessities and luxuries, and where a demand does not exist it creates. Yet, while the saturation point is seemingly infinite, the industry may encounter difficulties through injudicious or precipitous expansion. The natural course of development may be readily adhered to in this day of statistics through the agency of business economists, scientific and commercial specialists.

In recent years the chemical industries have been supplied with an abundance of economic information on production and consumption. If this information is wisely used to direct sound development there is no reason why the United States should not continue to be the leading factor in the chemical industry of the world.

A WORLD PERSPECTIVE *of Chemical Engineering Industries*

That American chemical engineering industries have attained a position of world leadership is clearly indicated in the large world map and wall chart, published as a special supplement to this issue of *Chem. & Met.*

At the International Economic Conference held by the League of Nations in Geneva in May, 1927, the United States was acknowledged to be the largest single factor in the world's chemical industries—accounting for one-half of the world's production and a large share of world trade in chemicals. This dominant position is effectively pictured in the *Chem. & Met.* World Map of Chemical Engineering Industries, which brings together for the first time much interesting information on the size and location of these industries in the principal countries of the world, their sources of raw materials, and the volume and distribution of world trade in chemicals.

Selling the Technical Product to the Technical Man

ALTHOUGH we cannot hope to cover technical product selling and buying within the bounds of one magazine, it is entirely possible to touch several of the high spots. Every reader of *Chem. & Met.* is in some way interested in equipment and material exchange. He will find many valuable ideas in the following pages among such subjects as the place of the chemical engineer in sales and service, relations of buyers and makers and the use of standards, advertising and technical publicity.

Standards and Specifications Demand Attention of Both Buyers and Sellers

By F. J. Schlink

Assistant Secretary, American Standards Association, New York

WHEN it is considered that a single large public utility buys a wider variety of goods than are listed in the catalog of the largest mail order house, it is plain that some sort of systematic approach to the problem of purchase is necessary. Evidently some kind of definite technique is required to reduce the questions of grade, quality, and performance to any sort of tangible form. The magnitude of the purchasing agent's responsibility will be appreciated in the light of the figures set down by Boffey and Gushee,—that one dollar lost through injudicious purchase is equivalent to a loss of ten dollars of sales. Every technical man connected with problems of purchase should read the 260-page survey of "Standards in Industry" published in the Annals of the American Academy of Political and Social Science, May, 1928.

IN ALL BUYING for industrial purposes, where economy is a factor, we must seek the aid of technical requirements as to materials, processes or performance, or some combination of these, plus laboratory or factory tests of varying degrees of elaborateness and difficulty. Specifications, in so far as possible, should be based upon performance, rather than materials or methods of manufacture. More and more, experts are coming to find ways in which the end result obtained in manufacture of a product can be defined and determined, with only secondary concern, if any, as to the means used by the producer to obtain those results. One of the great contributions of the Bureau of Standards to the specification movement has been its emphasis upon specifications which govern performance rather than materials and factory processes, and this, it is plain to see, is the trend that will dominate in the specification work of the future.

The reality of the problem of specifications and tests may be well judged from such facts as a survey carried out by one great utility which found that only 28 per cent of the products it purchased from suppliers had been subjected to proper manufacturing control. No degree of reputation or of good intent on the part of a producer can compensate for lack of knowledge of proper technical requirements in the production of his goods, adequate inspection to maintain quality and performance, and research to determine new methods, new materials, and new ideals of performance.

The development of specifications is a matter of high complexity involving a nice balance between conflicting commercial and technical considerations of compelling importance. Whenever possible, nationally recognized specifications, representing the reasoned consensus of all basically interested groups, should be used. The cost of unnecessary deviation from standards is usually so high as to be unwarrantable.

SPECIFICATIONS separate the significant from the inconsequential, measurable qualities from those that are intangible and perhaps unreal. Specifications rightly penalize the incurring of useless expense to provide talking points and sales appeals of the sort that cannot be justified on economic grounds or do not belong in the realm of aesthetics. Through specifications, buyer and seller speak the same language of engineering, bereft of ambiguities and non-existent distinctions.

The basic object of specifications is to determine the equation between cost and performance, and then to set competing bidders into the position of furnishing goods of equivalent service value at prices reflecting their respective degrees of initiative, skill, and efficiency.

The writers and users of specifications must maintain open minds. They must be ready to take advantage of every real advance in the art. Proper use of specifications should foster the adoption of such changes by focusing the attention of critics upon obsolete or obsolescent points that should be discarded or changed. It is an interesting fact that in every field in which the problem of specifications has been seriously approached, a rise in the quality of the product has tended to come about; and in a number of fields, such as that of zinc coating for iron and steel products, under the procedure of the American Standards Association, specifications have been turned to as an essential technique for bringing up the grade of goods that have been depreciated through a long period of sharp competition where price questions were paramount and quality was given less and less consideration.

Chemical Engineers Needed in Technical Sales Service

By F. J. Curtis,

Chemical Engineer, Merrimac Chemical Company, Boston, Mass.

RECENT years have seen an increasingly large number of chemical engineers turning to sales work or to technical service in connection with sales. These engineers are men with some practical operating experience: this enables them to possess that right point of view called "practical," which allows them to understand the viewpoint of other operating men and win their respect.

There are two general types of selling which apply to all commodities. In the first, the product is one that must be used and the only question is, whose product? For instance, aluminum sulphate is nearly universally employed as a coagulant for water. Most brands of commercial aluminum sulphate from reputable manufacturers are chemically alike. This material must therefore be sold on the standpoint of price, service, and other such factors. The second type of product, however, is one that is not now being used. The potential consumer must be shown the nature of the material, the way it works, and the advantages to be gained by its use either in greater ease of operation, improved product, or lessened cost.

IN THE LAST few years sodium aluminate has found favor in the water purification field, particularly in places where alkalies were added with the ordinary sulphate of alumina. In this case the engineers operating these plants had to be shown the advantages to be obtained by the use of the new chemical in conjunction with the old before they were willing to try it. Laboratory tests had to be made on the various individual water supplies, the necessary quantities had to be determined, plant runs made, and questions of control decided before smooth plant operation was achieved. The various managements had to be convinced that there was an advantage to be gained from the improved quantity of water so treated, or in improved operation of the plant, or in costs of coagulation.

For the first type of selling, the ordinary non-technical salesman may be quite satisfactory. For the second type, a technically trained man is in order. Three broad divisions may be made in the fields involved. There is, first, the sale of equipment which includes all kinds of machinery as well as materials used to contain or mold the product in process. The second division includes the materials themselves,—either the basic raw materials or those which are used to modify them. These may be chemicals, dyes, ores, fibers and so on. The third division is concerned with the resultant products of manufacturing operations such as paper, steel, leather or fabrics. In each of these divisions there is good reason for choosing chemical engineers as salesmen, although the largest need is encountered in the first group.

A CHEMICAL ENGINEER may be used in the sales department either as a salesman or as a technical service man. As a salesman he must be equal to the non-technical man. He must have that indefinable ability to meet people well. Then, he must know his product and be able to talk about it in a convincing manner. In this regard the chemical engineer, understanding as he does the scientific basis of the making and use or operation of his product and in his ability to talk the same language as the operating man, has a decided advantage over the non-technical salesman.

His background of technical experience enables the sales engineer to speak with authority and in addition frequently gives him entrée into the plant which would be denied the non-technical man who ordinarily has no reason to penetrate beyond the purchasing agent. Among other things, this ready entrée frequently enables the sales engineer to check the causes of complaint before they become serious and frequently before the purchasing department has any intimation of trouble.

However, the fact that a sales engineer has a dual job may interfere in his carrying out of either function and tend to detract from his value because his opinion may be considered biased. This has given rise to the institution of the technical service man, who while he is connected with the sales department is not concerned with any individual sale or customer and thus goes into the plant with the assurance that more weight will be carried by his scientific information. This man frequently handles complaints besides giving information of a consulting nature.

Even more than the salesman, the technical service man forms friendships with the customer's engineers and chemists. This enables him to gain a knowledge of the customer's processes, to find out how the products are used, and the influence of various materials. This enables him to suggest improvements both in materials and in processes. For example, some years ago it was found in using sulphate of alumina for sizing paper that a considerable yellow color resulted. Investigation showed this to be due to iron in the ferric condition. Reduction of this iron to the ferrous condition in the process of manufacture of the aluminum sulphate eliminated the yellow from the paper, thereby improving the product.

IT IS in the development of new products that the service man finds his greatest advantage. By means of his contacts in the various industries he studies requirements of all kinds. With these as a basis he finds out how a product may fit these requirements or how it may be modified to do so. Problems involved in the application of the new material are often solved in the customer's own laboratories or in plants in conjunction with the customer's technical staff, particularly in industries which are not run as yet in a scientific manner.

Among the technical service man's duties is the advising of customer's company officers on technical subjects. Where the officers are not technical men themselves this is a very important function which enables them to have sufficient and correct information on which to base their decisions. Production men are often tied down to their own plants and unable to follow outside technical developments. The technical service man, circulating around among various plants, brings in this information. At the present time, when many sulphuric acid plants are changing from sulphur to pyrites, the managements are being faced with the problem of production and elimination of the dust incident to the burning of pyrites. A technical service man found that there had been invented and applied in Europe a furnace which went to the heart of the difficulty, and instead of building expensive apparatus to eliminate the dust, built a furnace which produced no dust. Thus one of the technical

service man's most important duties is that of keeping in touch with the developments in all of the industries which are served or affected by his company's products.

It might appear that these two phases of chemical engineering in connection with sales will eventually be merged into one, with the elimination of the technical service man. However, it seems that this arrangement presents enough peculiar advantages to warrant the continuation of the two divisions and that the technical service man is not simply a stop-gap between a non-technical and a completely technical sales department. It seems probable, therefore, that even when selling is fully recognized as a profession for chemical engineers, the more detached and scientific attitude of the technical service man will remain a desirable function.

Sales Engineering—A Necessity in Equipment Sales

By Lloyd C. Cooley,
Sales Engineer, Swenson Evaporator Company, Harvey, Ill.

IT HAS BEEN unquestionably proven in recent years that the technical man has a definite place as a salesman in today's selling of technical products. The chemical engineer who goes into this field has a broader function than the non-technical man who might attempt it. The sales engineer, as the technically trained salesman is usually known, deals not only with the purchasing agent, in his capacity as salesman, but also with the engineer of the buyer organization, in his capacity as a consultant.

Under the usual system, the buyer's engineering department prepares specifications, while the purchasing agent asks for and receives bids, interviews salesmen, assembles all data and, in theory at least, awards the job to the lowest bidder. Such a cycle is easily followed out in the case of the purchase of standardized products such as cast iron or pipe, but when an opportunity for difference of opinion exists, when various non-standard articles, all within the specifications, are submitted, the problem is not so easily solved. In this class might be pumps with unique features, new types of evaporators or continuous stills. Cases such as these, and they are usually the rule rather than the exception in chemical engineering equipment, bring the sales engineer into the picture.

It is conceivable, of course, that the buyer's chemical engineers should be so well versed in the requirements of their field that outside advice from equipment manufacturers would be extraneous. It is rare, however, that the engineering department is able to keep abreast with every development in the field and quite unlikely that it is in a position to specify intelligently and unaided in allied fields. Hence, while the buyer's engineers frequently feel the necessity for assistance in preparing specifications, they often hesitate to call in the equipment manufacturers' representatives for fear of putting themselves under obligations to purchase. The purchasing agent is often encouraged to issue a call for bids before the exact requirements have really been determined.

Nevertheless, such consulting service in the preparation of specifications is definitely a function of the sales engineer. He should not consider that the service involves obligation on the part of the buyer. The seller's compensation comes from the opportunity that is presented to learn the buyer's needs and to mold the buyer's requirements, while the latter can thus tap a fund of valuable information which is frequently unavailable in his own organization.

Suppose the buyer's organization wishes to specify equipment for entirely new activities or make decided changes. Perhaps it now becomes necessary to produce alcohol, to refine rosin, to evaporate calcium chloride solutions. Each of these items involves a large amount of technical knowledge which may well be entirely outside the province of the buyer's engineers. The sales chemical engineer, when he is called in, can picture the whole requirement to the plant chemical engineer. The latter finds that "alcohol cooking" is more than a bootlegger's term, and more than an assortment of tanks, yeasts and pot stills. He finds it as a highly technical, highly developed art which must be interpreted to him by a man with training similar to his own.

Or the question of improving the rosin distillation equipment comes up. The sales engineer can advise concerning the possibilities of using, say, aluminum tubes or bronze tube sheets or a stainless iron vapor head. Perhaps it is a matter of improving the steam economy of a calcium chloride evaporator. The man who is in the business of producing chemicals such as calcium chloride by old-fashioned methods will probably not understand the effect of the so-called excess boiling point of concentrated calcium chloride solution on the possibility of steam economy improvement, nor know the limitations imposed on the number of effects in which the evaporator can be built. The purchasing agent could hardly be expected to consider these technicalities and the plant chemical engineers might well overlook them. It is the sales engineer who must include these considerations in his calculations before he offers equipment for sale.

Thus it appears that the sales engineer has ceased to be a luxury and has become a necessity in most technical equipment selling. As a consultant, his contact with the technical members of the buyer's organization induces good will. As a salesman, his opportunity to gauge the user's needs correctly makes for equipment sales that stay sold.

Correct Alloy Recommendations Require Users' Co-operation

By R. J. McKay,
Director of Technical Service
International Nickel Company, New York

WITH THE INCREASE in the number and types of alloys of high corrosion resistance now offered to the chemical engineering industries, a more complete technical or consulting service on the part of the alloy producers is developing. This is an engineering service, carried on in an engineering manner, which strives always to select the right alloy for a particular use. The engineers employed in this work are, or at least should be, familiar with a wide range of chemical processes and the alloys suited to them. Such technical service usually has a place in the organization of the alloy manufacturer.

Under this arrangement the possession of data and general information on alloys is a part of the technical service engineer's equipment, attained through his organ-

ization connection. The knowledge of chemical processes, however, must come largely from customer organizations. This method of obtaining this knowledge is the only one available, as process information must come from the outside. The engineer's success in obtaining it depends on the ability and willingness of the customer company to supply the necessary data.

IN THE MAIN, the engineers who handle the technical service for the alloy manufacturers possess high ethical standards and, through their training and experience, have learned to differentiate between information which they can use generally and that which must be held confidential or forgotten. In order that the judgment of these engineers may not be warped by sales and production influence, it is desirable that their position in their own organization should be separated from these departments. However, the technical service engineer should, of course, be completely conversant with the properties and possibilities of his own products. He must be able to show the customer's engineer how to use them most advantageously and determine with him just what service may be expected under a given condition.

In order to do this intelligently it is necessary that the technical service engineer should know the pertinent facts in connection with the use which is to be made of the alloy. For instance, it is impossible for the manufacturers to give a correct judgment on whether their metal will stand a given pressure and temperature condition unless they also know what material or atmosphere will be in contact with it. It is just as impossible for them to judge the service in contact with a given material unless the conditions with respect to pressure, temperature and other vital factors, such as active impurities and atmospheric oxygen, are known. With the present knowledge of chemical and physical properties of metals it is possible to predict service to a very large extent when these pertinent facts are given. The experience gained in one case is of the greatest value in subsequent cases but this does not necessarily entail the passing on of any information about the conditions of the previous uses. It must be remembered that the technical service men to whom this information is given are not connected with a competitor of the customer company and have nothing to gain and everything to lose in transmitting it.

These statements are, of course, made on the basis of the technical service organizations as they are set up in a large number of important companies today. The human tendency to see one's own advantage in a favorable light is a form of deception we are all familiar with. This tendency, fortunately, is relatively less common among engineers due to their training. And, as in all other activities, it is necessary for progress that we have faith in our neighbors' trustworthiness until it is disproven. Though we lock our houses against thieves none of us go so far as to lock out all visitors because some few might possibly be thieves.

The foregoing facts show a common-sense need for better co-ordination of knowledge between potential alloy customers and producers. Cases of improper application of alloys have been rather frequent in the past and many of these cases have been due to a lack of information on the part of the manufacturer as to the full conditions of use. And if the trend of the last five years is indicative, we may expect during the next few years a much greater consumption of high-priced special alloys, which, if properly used, will result in an increase in the efficiency of chemical manufacturing apparatus.

IT IS EVIDENT that an increase in efficiency for both manufacturer and user will hinge largely on the understanding between the two. Proper interchange of proven knowledge will yield an increasingly smaller number of expensive attempts at using unsuitable alloys. It will also give a more rapid allocation of the many new alloys to their proper competitive positions, which is an obvious advantage both to the manufacturers and users in increasing the rapidity of returns from the new developments that may be expected. Even though information might conceivably fall into the hands of an untrustworthy service engineer and a company suffer a small loss, experience has taught that this is much less serious to the alloy user than an almost certain forfeit of many thousands of dollars because of failure to give the alloy maker the information he needs to make a sound recommendation.

Are Equipment Manufacturers in the Consulting Business?

By J. Madison Browne
Chemical Engineer, New York

THERE is a phase of chemical equipment selling which has caused a good deal of worry to progressive equipment manufacturers within the last few years. This is the matter of engineering services of a consulting nature which the manufacturer has been giving freely whenever these services have been required by prospective customers. Manufacturers, of course, recognize that one of their first duties, and a cost of selling which they are rightfully obligated to assume, is for research with an end to improving their product, whether it be in the natural course of events or at the request of a customer. But beyond this, services of investigation, of survey, of extensive research performed at the request of a possible customer should certainly not be an addition to the manufacturer's overhead. This abuse has previously been recognized by the technical press and by the manufacturers themselves, but nothing has been done about it and the condition still exists.

What it amounts to is that the manufacturers have been put in competition with the private consultants, that the concerns for whom the work is done rarely pay for it, at least for more than a part, and that those equipment buyers who do their own development work foot the greater part of the bill in the end.

For example, a small manufacturer who is without the necessary engineering facilities for an investigation, owns a large plot of stump land. He goes to a manufacturer who spends considerable time and money in determining what it would cost to develop the plot for the production of rosin and turpentine. He designs a complete plant and submits it to the potential buyer in the hope of selling him some of the equipment required, whereupon the customer may do one of three things. He

may accept both the design and proposal, he may abandon the project, or he may submit the plans for competitive bids which naturally can be made lower than the original proposal as no development expense need be included.

If, as frequently happens, either of the latter courses are taken, the maker of the proposal has been saddled with a large item of overhead for which he receives no compensation other than experience. He may perhaps at the same time have antagonized two or three consultants who should have liked to do the job. Only the man who requested the bid, and perhaps some job shop which has no engineering department, has gained. Meanwhile, the manufacturer must charge off the expense to his future sales and the loss is passed on to the customers who actually buy.

This system is manifestly uneconomic and unfair. If competition were to be eliminated, this problem would go with it, but others would be substituted. The buyer has as much right to the benefits of competition as the equipment builder has to a fair return for the often costly consulting service he has had to provide to effect the sale.

A number of suggestions have been made to correct the trouble but none has been accepted. A comparison of the proposals brings to light one system which would get at the root of the difficulty with benefit to buyer, manufacturer and consultant alike. It cannot be carried out by one manufacturer or a half a dozen. It will take concerted action on the part of the majority. In brief, all development work of reasonable cost and in the normal line of each builder's business may be absorbed in the overhead in the usual manner. Only unusual services which verge on the consulting, such as surveys and extensive investigations, will be affected. When such is to be the case, a manufacturer, or perhaps several will bid for the investigation. One will carry it out. If his proposal is accepted, well and good—the cost of the survey will go into the overhead. If the proposal is not accepted, the client pays, whereupon he may call for further bids on the basis of the survey and every bidder will be on an equal footing.

This suggestion, radical as it may sound, would actually be carried out with considerable ease. Although equipment users might grumble a bit at the start, the decreased cost which could be charged for equipment proper would go far toward convincing engineers in general of the essential validity of the plan.

Advertising—to Help in Selling Your Technical Product

By Charles Wadsworth
New York

TECHNICAL or business paper advertising is valueless unless it is useful to two people—the reader of the magazine and the advertiser that places it in the magazine. Before we try to define exactly what we mean by useful it might be worthwhile to examine the history of technical advertising. Not many years ago it occupied a peculiarly random place in the affairs of the average company. It's rather like the long-winded preacher who was discoursing on the minor prophets. He reached number seventeen or eighteen and disclaimed as follows: "Now we come to Habakkuk. What place shall we give Habakkuk?" A tired voice from the rear replied: "He can have my place. I'm leaving."

So the first era of technical advertising was the Habukkuk era. It didn't seem to have any fixed place or function. The preparation of the advertising was assigned to the purchasing agent, to the shipping clerk, to the office boy, or even, and worst of all to the president. In those days noble, whiskered countenances gazed proudly at yawning readers. It was the vogue also to see how many words and illustrations could be crammed on a page, touching in detail of the development of the industry, of the plant, of the product. It would have been just as valuable to run a necrology of the founder's family.

Unquestionably, although some of us who laugh the hardest at the "good old days" may still belong to the Habakkuk era, there has been a marked improvement in technical advertising. Perhaps the greatest factor in this improvement has been a better understanding of its functions. The realization that good advertising is designed to produce a simple, definite result led advertisers to a study of what technical advertising could accomplish. On the one hand it was found that advertisements could produce so-called coupon returns. And, at the other extreme, many advertisers used technical or business paper advertising to influence prospective buyers in their attitude toward a company. This is institutional advertising.

Between these two extremes there are thousands of different specific results that technical advertising has accomplished and can accomplish. But it cannot be too strongly emphasized that the best advertising (and that means successful advertising) is generally aimed to produce a simple result.

It may be profitable to mention three or four points in connection with the aiming of advertising campaigns; because, after all, no matter how well an advertisement is constructed, no matter how well the copy is written, no matter how good the illustrative material, if the campaign is not aimed in the right direction, it will not accomplish its objective.

It should be noted first that we are discussing advertising campaigns. It is a frequent fault of technical advertisers to regard a single advertisement as a campaign. Under certain conditions it is conceivable that a single advertisement is desirable. But the most elementary principle of advertising is that of repetition. And, therefore, it is generally true that any advertising effort must be sustained.

The use of a coupon in advertisements as a means of getting attention has been greatly abused in technical advertising. Many advertisers have regarded a campaign as a success if the coupon returns were high, and conversely, as a failure if scant. Most advertising men believe that coupons should be used conservatively. In the technical field especially, coupon returns are exceedingly unreliable as a criterion of success.

Too many technical advertisers attempt to tell the whole story in every advertisement. This is probably a mistake. It is justified on the basis of giving as much information as possible, but that's not primarily the function of an advertisement, but of a catalog.

Not infrequently however, a more serious error is

made. That error is in focusing a technical advertising campaign not on the most out-standing advantage of a product, but on all of its good points. In our desire to give as much information as possible (and it's a very laudable desire) we have sometimes failed to remember the one fundamental of simplicity. Any statement is open to exception but we are pretty close to bed-rock if we say that good technical advertising must take into account the fundamental principles of repetition and simplicity, and that bad technical advertising is often bad because it fails to do just that.

Legitimate Technical Publicity Builds Prestige and Promotes Sales

By Anthony Anable
Director of Publicity, The Dorr Company, New York

TECHNICAL PUBLICITY, in other words, accurately prepared editorial matter of a technical nature relating to scientific advances, process refinements and new uses for products and machines is a slightly understood yet potentially effective method of building prestige and promoting sales. Representing, as it does, the collective philosophy of an industrial concern on the technical problems which it is called upon to face in its everyday business existence and tying in, as it should, with sales policy, advertising appeal and industrial research, technical publicity is unquestionably a factor in marketing the technical product.

The sellers' technologists and the buyers' technologists have similar professional affiliations and keep abreast of advances in their industries by reading the same magazines. The wide circulation of the better type of technical magazine is ample evidence that the education of the technical man is never complete and that he looks upon such publications as a broadening influence and a source of constructive and helpful ideas.

A virile technical press is today the only agency which takes an idea from its industry and interprets it for the benefit of a wider audience, making it available and intelligible so that the busy executive and tired worker can grasp its importance in a minimum of time and with the least mental effort. A backward glance through the recent years of intense industrial development shows that many of those ideas which have virtually remade plant practice have been advanced and developed by the technical product manufacturers, through painstaking research and constructive sales effort.

Ralph Waldo Emerson expressed this situation tersely about 70 years ago when he said "After all, the greatest meliorator of the world is selfish, huckstering trade." Calkins in his recent book, "Business the Civilizer," showed that one of the greatest forces for progress is the effort of manufacturers to extend old and open up new sales outlets through improvements in their products. The seller of technical products, if his lips are unsealed, has much to say on those things which he is studying and developing which may have momentous effects on the practice of the next decade. An active technical publicity department is the mouthpiece of the seller. It has become a force for prestige building and sales promotion since it has shown that a better understanding is reached between buyer and seller when the buyers' technicians, who influence and frequently authorize purchases, know more about what the sellers technicians are doing along the lines of new products, process refinements and improved practice.

The director of technical publicity is a liaison officer between his company on the one hand and his company's clients on the other. The effectiveness of what he has to say is directly proportional to the propriety, good taste and accuracy displayed, and inversely proportional to the use of what has been rightly labeled propaganda and free advertising. His technical knowledge of the complexities of his company's business must be supplemented by an appreciation of commercial factors and sales policy. As one whose efforts are judged by the influence they exert on an educated reading public, he must be a shrewd judge of technical public opinion and those things which stimulate legitimate interest. Finally, as a frequent contributor of articles, he must have a clear, accurate and sympathetic comprehension of the editorial viewpoint, what it is, why it is what it is, and by what standards it accepts or rejects manuscripts.

Technical publicity has a place—an important place—among the factors entering into the effective marketing of the technical product. There is no overlapping of functions between it and advertising. A broad-minded editorial group today welcomes the seller as a contributor of constructive material, beneficial to industry in general, and does not consider the subject matter inconsistent with editorial policy if the reader interest thus created happens to engender prestige and promote sales. That company is indeed super-modest which does not claim credit publicly when credit is rightfully due. The alternative is to slip into obscurity.

Export Associations Facilitate Foreign Trade

At the present time there are, according to *Commerce Reports,* 56 export associations formed in the United States under the Webb-Pomerene law. Of these, 15 are of interest to the chemical engineering industries, including groups interested in the export of naval stores, tires and rubber, soda pulp, abrasives, cement, phosphate rock, sulphur, paint and varnish, alkali and zinc.

The Webb-Pomerene law permits American business men to combine in the form of export associations to co-operate in export trade, but export trade only. Such associations are exempt from the Sherman anti-trust law as long as the conditions of the Webb law are maintained. The associations referred to above are as follows:

American Pitch Pine Export Company, New Orleans
American Soda Pulp Export Association, New York
American Surface Abrasives Export Corporation, New York
American Tire Manufacturers' Export Corporation, New York
Cement Export Company, Philadelphia
Florida Hard Rock Phosphate Export Association, Savannah
Florida Pebble Phosphate Export Association, New York
Gulf Pitch Pine Export Association, New Orleans
Naval Stores Export Corporation, New Orleans
Phosphate Export Association, New York
Rubber Export Association, Akron
Sulphur Export Association, New York
United Paint & Varnish Export Company, Cleveland
U. S. Alkali Export Association., Inc., New York
Zinc Export Association, Inc., New York

RECENT PROGRESS OF TECHNOLOGY

Editorial Staff Reviews

THIS magazine, *Chemical & Metallurgical Engineering*, is the successor to *Metallurgical & Chemical Engineering*, which in turn, was a consolidation of *Electrochemical & Metallurgical Industry* and *Iron & Steel Magazine* effected in July, 1906.

The magazine was originally founded as *Electrochemical Industry*, in September, 1902, and was published monthly under the editorial direction of Dr. E. F. Roeber. It continued under that title until January, 1905, when it was changed to *Electrochemical & Metallurgical Industry*. In July, 1906, the consolidation was made with *Iron & Steel Magazine*, that had been founded eight years previously by Dr. Albert Sauveur. In January, 1910, the title was changed to *Metallurgical & Chemical Engineering*, and semi-monthly publication was begun Sept. 1, 1915. On July 1, 1918, the present title was assumed and weekly publication was begun Oct. 1, 1919. Monthly publication was resumed in March, 1925.

Dr. E. F. Roeber was editor of the paper from the time it was founded until his death on Oct. 17, 1917. After a brief interim he was succeeded by H. C. Parmelee. Ten years later, Nov. 1, 1928, Mr. Parmelee was made editorial director of the McGraw-Hill Publishing Company and was succeeded in the editorship of *Chemical & Metallurgical Engineering* by Sidney D. Kirkpatrick.

The editorial staff of the magazine comprises: S. D. Kirkpatrick, editor; H. M. Batters, market editor; James A. Lee, T. R. Olive, R. S. McBride, Paul D. V. Manning, assistant editors; Richard Koch, editorial assistant.

Heavy Acids Demonstrate Important Process Refinements

ALTHOUGH there have been no revolutionary developments in the technology of the heavy acids within the past year, a number of interesting refinements have been introduced and several trends established in recent years have spread, showing that the tendencies are technically sound.

Sulphuric acid, the big brother of the heavy-acid field, no longer enjoys its undisputed position as an index of chemical activity, but this has not prevented the 1928 production from being larger than it has been in any previous year since the war. A very considerable part of the acid produced represents a return to pyrites, although figures are not yet available to indicate how far brimstone has lost its position, gained during the war years. There is evidently, however, a leaning toward pyrites on the part of at least a portion of the industry.

The most important contribution of the year is probably the introduction of vanadium catalysts for use in the contact process. While development has been going on for several years, it is only within the last nine months that the two organizations engaged in this work, Monsanto and the Selden Company, have announced the new masses publicly. Vanadium catalyst masses are not only less expensive than platinum, but offer a higher conversion, ranging under favorable circumstances from 97 to 98 per cent. In addition, and perhaps most important of all, they do not suffer poisoning from hydrogen chloride or arsenic. This naturally allows high average conversion over much longer periods than is possible with platinum.

Nevertheless, if the contact process has been improved, the chamber process does not linger behind. Despite fairly general belief that the former will eventually outstrip the latter in utility, they remain neck and neck in their respective fields. Improvement in one is matched in the other. The contact process continues to be considered more suitable for the production of 66-deg. acid and stronger, while the chamber plant remains supreme for 60-deg. acid and weaker. Two influences contribute largely to the latter's ability to hold its own—the now widespread displacement of Chile nitrate by ammonia as a source of nitrogen oxides for the chambers and the gain in the use of the so-called quick processes, principally the Mills-Packard type of water-cooled chamber. With such systems, it has been possible to reduce chamber volume from the former practice of 12 to 20 cu.ft. to as low as 3 to 3½ cu.ft. per pound of sulphur per day. This has been rendered possible with practically no increase in niter consumption, although such systems have a tendency to get out of adjustment more easily than the larger chambers.

There seems to have been little change in HCl. Most plants have taken to towers instead of tourilles or bottles for absorption. Tower users have generally abandoned coke as a packing material in favor of ceramic shapes. Synthetic HCl, produced by burning hydrogen in chlorine, is gaining in importance by reason of the amount of these gases available as byproducts of the electrolysis of salt and which cannot find a more profitable market. At least six caustic-soda producers have installed such plants. Meanwhile, production of the acid from salt and H_2SO_4 or niter cake remains somewhat scantily in evidence, with only about one-fifth of the producing capacity operating.

Nitric acid evinces no change in the technology of production from $NaNO_3$ but there is increasing favor for the ammonia oxidation method. Continued improvement in stainless iron has gone a long way toward solving the difficult corrosion problems that are encountered, while the advent of systems operating at pressures as high as 100 pounds has much decreased the size of plant required and simplified the matter of absorption. Five large oxidation plants, three of which are understood to be based on the pressure system, have been in construction or placed in operation in this country during 1928.

Nitrogen Technology Improves As Production is Increased

NITROGEN fixation plants in the United States which are active all use some form of the direct synthetic-ammonia process. The largest of these plants is the new installation of the Allied Chemical and Dye Corporation at Hopewell, Virginia, where manufacture of ammonia began late in 1928 and is rapidly expanding to an estimated capacity of 150 tons of NH_3 per day. A plant of similar capacity will be operated at Belle, West Virginia, by Lazote, Inc., when the present expansion of facilities there has been completed.

With the completion of these two new plants the United States will have a productive capacity greatly in excess of the ammonia requirements of the country if one excludes fertilizer needs. Hence, the Hopewell plant is to make synthetic sodium nitrate as its principal product, presumably marketing this altogether in the fertilizer industry. The other producers of the country have not yet indicated any similar plan, but it will not be surprising if 1929 discloses that a substantial percentage of synthetic ammonia must be utilized in some form other than ammonia or ammonium compounds.

With this expansion of the industry in the United States we are only beginning what most nitrogen optimists believe to be the successful establishment of nitrogen independence. We are adapting the foreign technology to American conditions and are adding many distinctly American improvements, especially in the field of catalysts and gas-handling equipment. Expansion, apparently proceeding along almost exactly parallel lines, abroad has resulted in the successful operation of a number of huge plants. Haber-Bosch plants at Oppau and Merseberg probably produced during 1928 540,000 short tons of nitrogen and the calcium cyanamide plants at Piesteritz and Trostberg nearly 100,000 short tons. British operations have also expanded. The largest works in England has a present capacity of 70,000 tons of nitrogen per year, and with additional units being constructed this will be greatly increased.

Modified technology in cyanamide production has reduced the power consumption per unit of nitrogen fixed by this process by about 40 per cent during the past four years. This improvement accounts for the substantial increases in output of cyanamide nitrogen which have occurred. The greatest advances in the direct-synthetic process reported from abroad appear to be in the low-cost production of hydrogen. Estimates are that at Merseburg pure hydrogen can be made at not more than 20 to 25 cents per 1,000 cu.ft.

Other plants report similar low costs. But it is very difficult to translate these cost figures for comparison with American conditions because of the differences in charge for raw gas used, the wide difference between labor costs abroad and here, and the uncertainty as to the accounting system used on over-head, management, and capital charges. Such comparisons as have been possible indicate that American technology has not lagged behind that abroad and that the main cost differences favoring the foreign producers lie either in governmental subsidy or general low-cost conditions which accompany lower standards of living in Europe. In this connection one can well consider the costs reported by Pallemaerts in his recent paper published in the last issue of *Chem. & Met.*

No outstanding changes in the technology of byproduct ammonia or Chilean nitrate recovery have been reported during the year. Improvements in processing methods have been largely refinements in the handling of materials or in heat conservation. It is worthy of note, however, that modified acid-phosphate technology now offers an outlet for ammonia liquor. Hence, many small carbonizing plants which in recent years have found difficulty in marketing their ammonia output are again encouraged by the prospect of prompt and satisfactory sales of ammonia, either as liquor or in the anhydrous form. Previously it appeared that such plants would have either to abandon ammonia recovery, which seemed impracticable, or to arrange for the conversion of ammonia into ammonium sulphate or other salt suitable for fertilizer use. As yet the prospect of ammonia liquor markets has not become sufficiently attractive to interest many small works with miniature coke ovens or retort carbonizing plants. Many such plants are still throwing away ammonia in the form of the weak liquor which results from the gas washing. However, the problem of disposal of this liquor without serious contamination of streams remains one of concern to both public officials and gas-plant executives.

New Technology and New Products Appear in Fertilizer Industry

NEUTRALIZING superphosphate with ammonia liquor promises to become an important feature of mixed fertilizer production as a result of one of the outstanding technologic developments made by the industry during 1928. As so used the ammonia liquor supplants calcium cyanamide and furnishes under present practice not to exceed 30 pounds of nitrogen per ton of mixed goods made.

The advantages claimed for the new technique are low cost of nitrogen, favorable conditioning effect on the mixed fertilizer, prevention of cementing of superphosphate and sulphate of ammonia, and the elimination of cyanamide which is regarded by some as both difficult to handle and somewhat objectionable in its behavior in the finished goods.

The fertilizer industry abroad has continued to develop a variety of new fertilizer materials. During 1928 "Kalkammon" was introduced by the Ruhr-Chemie A. G. at a price slightly less per unit of nitrogen content than ammonium sulphate. It contains about 17 per cent nitrogen as ammonium chloride and about 30 per cent of calcium carbonate; it was intended as a substitute for ammonium sulphate to be used in an effort to prevent development of acid soil conditions. The parallel development by Nitram, Ltd., the British organization, is "Nitro-chalk," comprising a physical mixture of ammonium nitrate and finely divided dried calcium carbonate. The calcium carbonate used is obtained at the Billingham plant as a byproduct of the gypsum process for ammonium sulphate manufacture and generally carries about 1.5 per cent of ammonium sulphate. As marketed, the new fertilizer contains either 10 or 15.5 per cent nitrogen, approximately half as ammonia nitrogen and half as nitrate nitrogen.

In the United States the fertilizer industry has undergone further consolidations during the past year and there is rapidly growing up a group of companies who recognize the essentials of chemical engineering technology and who are undertaking to follow whole-heart-

edly the approved trade practices which are prescribed by the code which the industry adopted about two years ago. These progressive companies are apparently finding themselves upon sounder financial footing and are rebuilding plants and introducing modern technology, all of which gives favorable promise for the future. The trend is so pronounced that the industry now outspokenly admits itself to be engaged in a chemical engineering enterprise, an admission in sharp contrast with the apparent attitude of many leaders of the old school who dominated the industry's activities only a few years ago.

Petroleum Technology— Liability or Asset?

SOME pessimist recently remarked that the oil industry has lost most money since technology took control of refinery operations. It would probably be more accurate to say that less money has been lost than would otherwise have been the case. The fact remains, however, that during the past few years overproduction of crude oil has tended to offset the advantages of many of the great technical advances. Thus the tremendous investment in cracking stills of improved design and economy has not yet been used to full advantage because of the flood of cheap oil. Likewise recent developments in fractionation and refining have permitted the industry to make high-grade lubricating oils and other products from low-grade raw materials, thus again writing down the value of large existing investments.

Fortunately most technical developments have been of a more constructive character. During 1928 practically all atmospheric distillation equipment was of the pipe-still variety in which tubular heaters are used. Stills of the shell type are rapidly being abandoned or modernized by equipping them with the various features of the modern tube-still installation. It was reported by Dr. E. W. Isom before the recent meeting of the A.P.I. that pipe-still efficiency based on utilization of fuel has been raised to 80 per cent or higher—thus becoming equivalent to standard steam boiler performance. Fractionation, through the almost universal use of the bubble tower, has developed to the stage where the precise methods of the laboratory can be duplicated on a continuous basis with large-scale plant equipment.

Technologists have also been active in the field of cracking despite the oil-field orgy. Efficiencies have been increased to such an extent that less than 10 per cent of fuel, based on output of gasoline, is now required whereas 25 to 30 per cent was common in early installations. Individual cracking units have been increased in size so that some now yield as much as 2,000 barrels per day. As indicated in the articles by Owen appearing in *Chem. & Met.* in recent months, the year 1928 saw the completion of a number of processes for vapor-phase cracking. These yield motor fuel of superior value from an anti-knock standpoint and are of incidental interest because of the byproduct hydro-carbons and alcohols that may be developed from them.

A commercial plant for the catalytic oxidation of petroleum is another development in the direction of chemical utilization. The product obtained by this process is largely used as a denaturant for industrial alcohol. Extremely interesting work has also been done on the direct oxidation of petroleum by means of a submerged flame. The process, although not yet operated on a large scale, has been shown to yield aliphatic alcohols, ketones, ethers, and esters of commercial interest. Production of isopropyl and higher alcohols from refinery gases has been largely confined to the single large plant at Bayway, N. J., but developments are underway that indicate a greatly increased output of these products, which during the year have been in exceptional demand.

Chemical engineering has been responsible for many improvements in normal refinery practice, largely either by perfecting closer control through special instruments such as temperature and pressure recorders, flow meters and similar devices, or by introducing standard equipment and processes of other industries.

These developments, scattered over a wide range of applications, are sufficient to show that the technologist is not the liability that our pessimistic friend would have us believe. In fact, without his contribution of efficient, low-cost methods, many refineries would not have been able to survive the oil industry's recent period of trial and tribulation.

Paper Industry Turns To Chemical Engineering

IN DECEMBER a newspaper was printed in Danville, Illinois, on paper made from cornstalks. This drew nation-wide comment and approval, for it meant more than the fact that a possible new source of raw material had been found for the production of paper. If it succeeds commercially, it means a new source of income to the farmers and a saving of our rapidly diminishing forests. The production of pulp from cornstalks and baggasse stand out as the most important technical developments of the year in the pulp and paper industry.

While the production of pulp from cornstalks is not in itself new, the development of a process that is economically sound will have been a real accomplishment. Most of the interesting work that has been done centers in the States of Illinois and Iowa where the plight of the corn farmer has given an added impetus to scientific attempts to solve the farm problem. In addition to making cornstalk pulp into newsprint stock it is used for making insulating board. It is principally in this direction that the work is being done in the chemical engineering department of Iowa State College. The U. S. Bureau of Standards has aided in this development by helping to finance the building of the experimental wall-board plant at Ames.

Another source of raw material for pulp making which has been tapped during the year is baggasse. This development has been confined to Cuba where sugar cane is as important as corn in Illinois and Iowa. Pulp from this source is used for the manufacture of blotting paper.

Among developments of particular interest to the chemical engineer, is the fact that pulp grinding stones made from synthetic abrasives have replaced in several plants the natural sandstones so long a standard. In another technical advance a Canadian mill has especially designed its acid plant supplying cooking acid for the digesters in order to conserve the heat and SO_2 content of the liquor and vapors normally blown off through the pressure relief lines during cooling.

Other advancements in pulp and paper-making practice during the past year include the substitution of rotary filters for deckers in thickening and washing pulp, the automatic weighing of chips used in the sulphite process, and the use of forced circulation for sulphate digesters.

The exacting requirements that are now demanded of the paper maker have forced upon him the use of chemical engineering. The result has been a radical change in the industry. Each year many valuable technical developments are made in processes, equipment and sources of raw material.

New Materials to Resist Corrosion

CORROSION of construction materials continues to demand the attention of chemical engineers; in fact, the recent important developments have been for the purpose of preventing this malady. Among the most noteworthy of these are the new alloys developed by the Krupp organization, aluminum protected alloys and ceramic materials for coating or surfacing purposes. Chromium has been popular for several years as a material of construction for corrosion resistance purposes, but during the past year its wear resistance property has been made use of for many purposes in chemical engineering industries.

The research organization of the Universal Oil Products Company has developed a ceramic lining suitable for protecting the larger elements of cracking units and other refining equipment subject to corrosion. Nine reaction chambers have been coated with the mixture of furnace cement, asbestos, sand and water glass, and it is reported that the results have been very encouraging. A series of tests made with sulphuric acid of various concentration and with sodium-hydroxide solution show that the material is resistant to the action of acids and alkalies. It is contemplated applying this protective coating to other forms of equipment such as for protection of reaction vessels and oil treating plants, particularly the acid-settling chambers; smoke stacks; conduits; transfer lines and in general where metal surfaces require protection against corrosion.

The year 1928 has seen chromium plating adopted for the first time as a wear resistant in the oil industry in cracking chambers, and in the paper industry on rolls and in evaporator tubes. The use of chromium in the oil industry on the Pacific Coast has proved beneficial in decreasing the corrosion of the cracking chambers when operating on oil containing a high percentage of sulphur. The tubes used in evaporators for evaporating waste sulphate liquor in the paper industry have shown considerable increase in life as a result of being chromium plated.

The electrochemical behavior of Alclad has made it of chemical engineering interest. In this product surface layers of pure aluminum are rolled on strong aluminum alloy sheets in such a way that the corrosion resistance of the pure aluminum is realized for the combination. The galvanic relation between aluminum and the alloy effect protection of the alloy at cut edges, and of alloy rivets used in conjunction with the sheet.

Alloys and steels produced under the Krupp Nirosta patents are used extensively in Europe and are now being introduced into this country. It is claimed that these new alloys offer greater resistances to acids at high temperature and pressures, and can be deep drawn, easily machined and welded. Nitralloy is used where it is desirable to have a case-hardened material to reduce the effect of wear and tear.

These improvements in construction materials have a widespread effect. There is no chemical industry that does not have trouble with equipment corroding or wearing. Materials that are resistant to corrosion or wear mean a large saving to any plant, for they mean not only longer life but less expense and trouble caused by replacing corroded or worn-out equipment.

Pacific Coast Industries Consolidate Their Position

DURING 1928 the Pacific Coast pulp and paper industry spent about $10,000,000 for expansion and improvement. Almost three times this amount was spent in 1927, mostly for new mills. The total number of mills on the Coast, including those of Canada, now numbers around thirty, while the rated capacity is a little over a quarter of the total for the United States. Some of the most progressive development work in this industry is now being carried on in the Pacific Northwest and continued improvement of already up-to-date methods may be expected during 1929.

The petroleum industry, in spite of overproduction, has kept up its growth. Several large Eastern companies have entered the territory through the purchase of large independent organizations. Practically all of the larger producing and refining companies are working under heavy research schedules for new products and methods. This work should bear much fruit in the next few years and it will be opportune since new wells are being brought in too frequently for comfort. A serious attempt at conservation by co-operative limitation of production will probably be made during 1929.

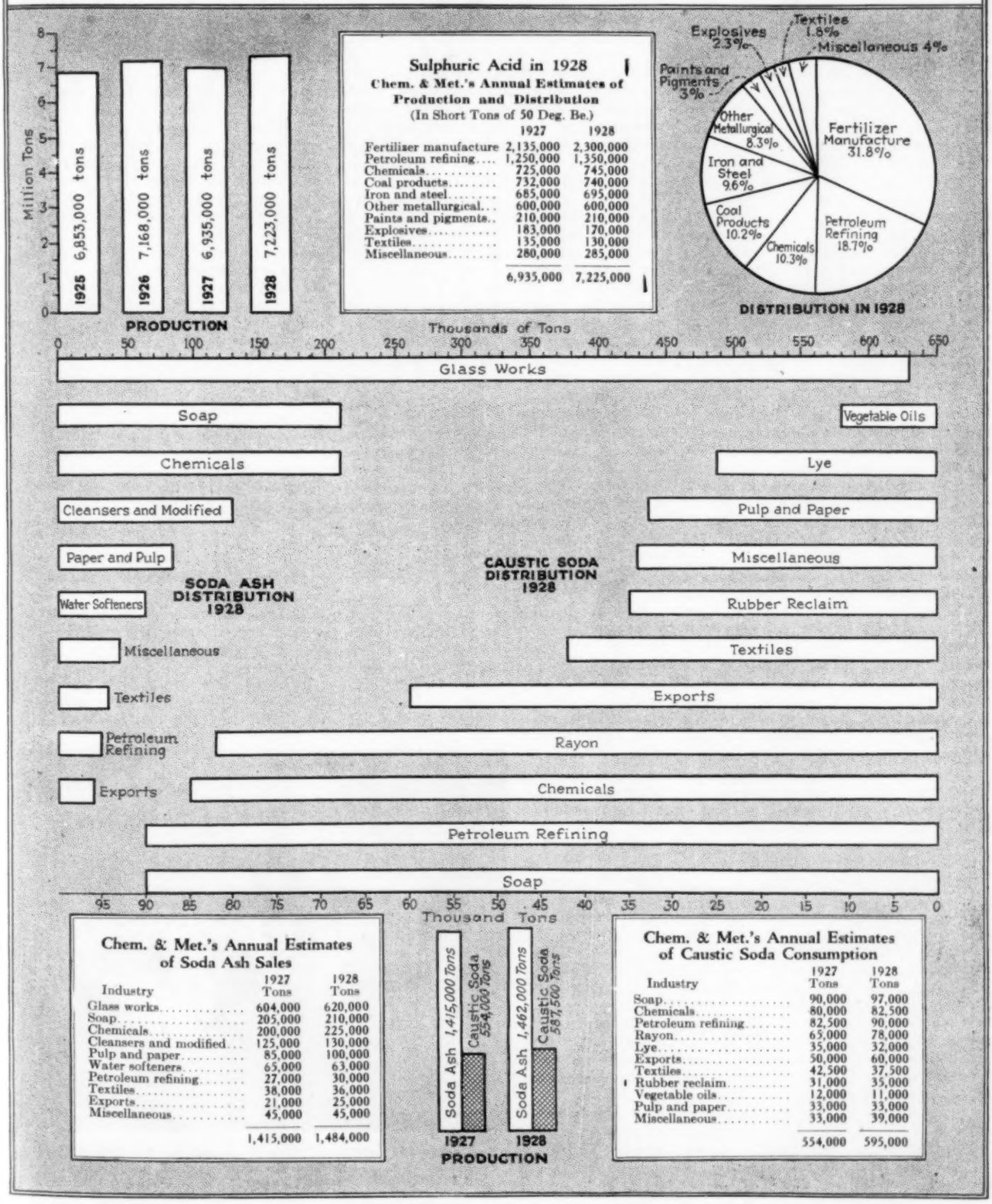
In the chemical manufacturing industries of the Pacific Coast there is now evident a realization of the imminence of Eastern competition. The Eastern manufacturer has apparently awakened to the attractiveness of this market but for some this awakening has come too late to prevent the Western business from passing almost entirely into the hands of local manufacturers. Many of the latter are branching out from the markets of the Pacific Coast and actively competing in Eastern territory. Pacific Coast industrialists, however, seem to realize that hard competition even at times of the "dumping" variety, is awaiting them. Accordingly they have increased their efforts to lower costs, improve quality and utilize wastes as byproducts.

The present year should see the entrance of a new Pacific Coast manufacturer into the soda-ash industry and there will probably develop an increased competition between this chemical and borax which dropped to a new low price in 1928. A third large producer of borax began shipping in November and it is likely that the price will go even lower in 1929.

Expansion and new factories brought the daily automobile tire production of Los Angeles plants to 20,000 casings and 25,000 tubes. One manufacturer has indicated that his tires cost less delivered in New York when made in Los Angeles than when made in Ohio.

Altogether the year 1928 was one of expansion within the chemical engineering industries and of a greater growth for those industries using chemical products than for the producers of chemicals.

Chem. & Met.'s Annual Estimates of DISTRIBUTION OF HEAVY CHEMICALS



NEW EQUIPMENT

Meets Increasing Demands of Improved Technology

WITH new processes springing up almost overnight and with the cry always more urgent for greater efficiency, equipment manufacturers have been put to it in the last two or three years to keep abreast of the field. That they have succeeded, however, is amply attested by the relatively enormous amount of new and improved equipment that has sprung into being. Not all the equipment is new in principle by any means—in fact, complete novelty is the exception although it is not entirely lacking. The improvements lie more often in the refinement of older methods of gaining results, in more accurate design, in better constructional materials, in new methods of fabricating.

There is some tendency toward standardization of equipment and of parts, although this is more evident in auxiliary than it is in primary chemical equipment. This is unfortunate and a state of affairs that the equipment manufacturers would be glad to change, but it hardly seems probable that any real strides in standardization will be possible while the industry persists in its present state of flux. The constantly changing aspect of chemical manufacturing bids fair to continue for a good many years to come, although some industries are beginning to show a fairly even tenor in their ways.

In some lines, a satisfactory degree of standardization has been attained. The Pfaudler Company, for example, has announced a standard line of enamelled kettles which is available in a large number of sizes. In other fields, companies such as J. P. Devine and the Buffalo Foundry & Machine Company have succeeded well in standardizing certain lines of evaporating and drying equipment. The centrifuge manufacturers have made notable progress in this direction as have some of the filter manufacturers. This is particularly true of the ordinary filter press.

IN AUXILIARY equipment, such as motors, power transmission equipment, pumps, valves and piping, heating and air conditioning devices, a satisfactory degree of standardization has long since been arrived at. These lines, where there is moving machinery, show a very gratifying tendency toward the adoption of anti-friction bearings. Manufacturers now generally concur in the use of special materials of construction for corrosion, erosion and high temperature resistance where necessary. This is part of the tendency to design this auxiliary equipment especially for the chemical uses for which it is intended without trying to adapt possibly unsuited equipment for the purpose.

Chemical equipment proper is moving in a number of directions. There is a distinguishable trend, although it is still not very widespread, toward the combination of functions within a single unit apparatus for greater efficiency and decreased labor. Such devices combine filtering and drying or drying and grinding as examples. There is also, due to the advent of many new synthetic processes, a decided tendency toward the use of high pressures and temperatures with the coincident demand for special alloys for construction purposes. There is proof that the philosophy of mass production has very completely permeated the chemical industry, in that certain types of equipment, notably crushers, kilns, driers, evaporators and thickeners are now being built larger than ever before.

Manifestly, with the great mass of equipment which has appeared in recent years, it is impossible to go into the entire subject with any degree of thoroughness. However, where equipment is new in principle it will be considered in some detail, while the general trends throughout the equipment field will be noted as they come to our attention.

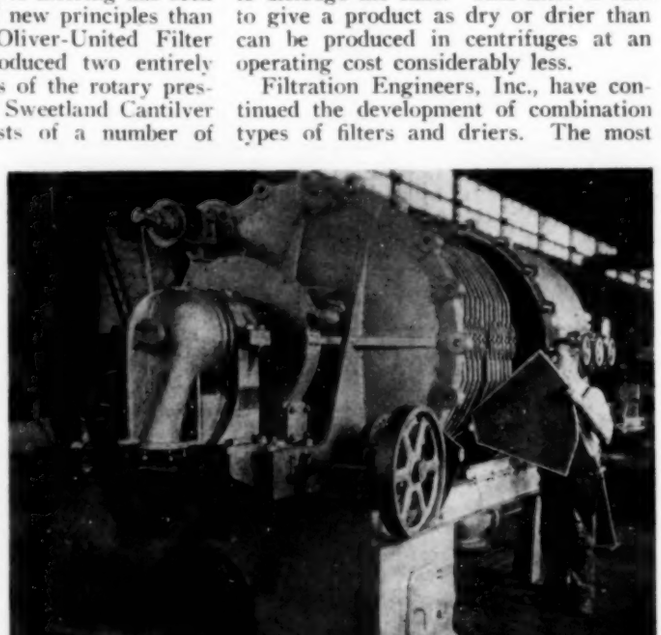
Filtering Equipment

Perhaps the field of filtering has seen more application of new principles than any other. The Oliver-United Filter Company has introduced two entirely new filters. One is of the rotary pressure disk type, the Sweetland Cantilver filter. This consists of a number of rotary filter disks composed each of several segments which are individually and easily removable for repairs. These disks are mounted on an overhung shaft and inclosed in a hopper - bottom casing capable of withstanding pressures up to 50 lb. per sq.in. which may be rolled back out of the way on a track to expose the filter elements for repairs. Individual sight glasses in the discharge from each row of segments, for examining the filtrate flow, make it fairly easy to determine the faulty element in case of a leak.

The rotating feature, the principal departure of the new filter from the Kelley type, makes for a better cake. The filter is provided with a speed change gear so that the disks may be rotated very slowly while under pressure, but driven at four times this speed when the cake is being sluiced off. The sluicing is accomplished by means of a perforated pipe which has a slight lengthwise reciprocating motion as well as an oscillating motion of rotation. This enables every portion of the disks to be reached by the spray water. So far, the filter has been applied in the sugar industry.

THE SECOND Oliver-United development is the salt filter which is finding application in the common salt industry as well as in the filtering of other crystalline materials. This is a modification of the standard Oliver vacuum filter and permits large filtrate flow at slight vacuum. An important change consists in the addition of a hood within which the salt or other crystalline cake on the filter is subjected first to steam and then to hot air, usually obviating the necessity for an air blow to dislodge the cake. This filter is said to give a product as dry or drier than can be produced in centrifuges at an operating cost considerably less.

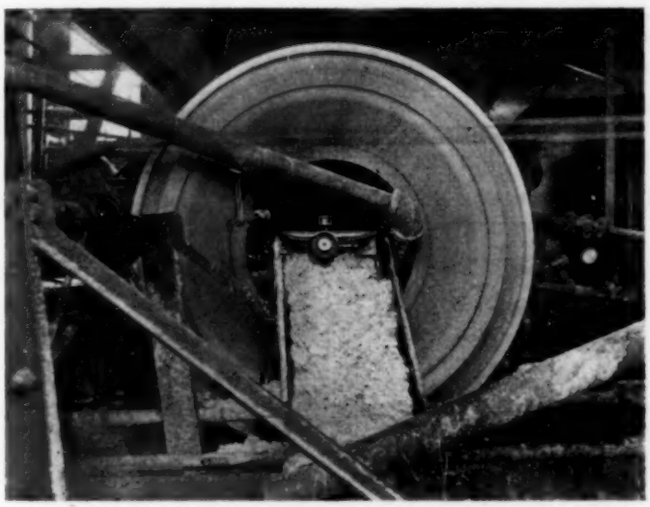
Filtration Engineers, Inc., have continued the development of combination types of filters and driers. The most



New Sweetland Cantilever Filter Developed for Use Where Higher Pressures Than are Attainable With Vacuum are Required, and Where a Rotating Filter Leaf is Desirable

recent development is a vacuum filter combined with an atmospheric drum drier for pottery slip. This is intended to give a certain desirable small percentage of moisture in the product. A weighted cloth belt which rolls in contact with the top of the filter drum firmly presses the cake around a number of continuous string belts which encircle both the filter and drier drums. The cake, without support other than the few strings, continuously leaves the filter and passes around the drier where the slip solidifies to conform with the drier contour and hence breaks loose from its conveying strings once the latter leave the surface of the drum.

The Shimmin filter, now known as the Dorrco, and built by the Dorr Company, is probably the most radical departure in recent years of filter construction. This is a general purpose vacuum filter which eliminates the conventional filter tank and makes use of filter sections arranged around the inside periphery of a drum. The drum itself serves as the filter tank and the settling of suspended solids produces a desirable type of grading against the filter cloth, as the largest particles settle first. The cake may be washed and blown as in the conventional type of filter. Discharge is made to a hopper within the drum from which the solids are conveyed by a screw.

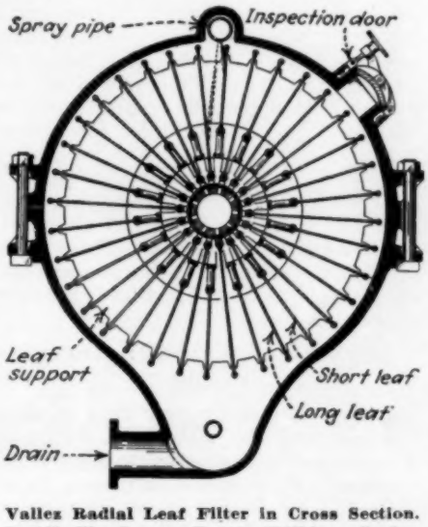


Dorrco Internal Drum Filter—the Most Radical Change in Recent Years in Filter Design

The Joubert & Goslin Machine & Foundry Company has introduced a new heavy-duty, general purpose vacuum filter featuring especially large liquid passages and a new type of rotary valve. The drum is of slatted construction divided into filter sections which communicate during the entire cycle, except for a short blowing period, with the inside of the drum and thence to a separator and vacuum pump. The ports of the filter sections within the drum each connect once during the cycle with a slide valve which applies air pressure to the section. This point of application may be varied to take place at any time in the cycle.

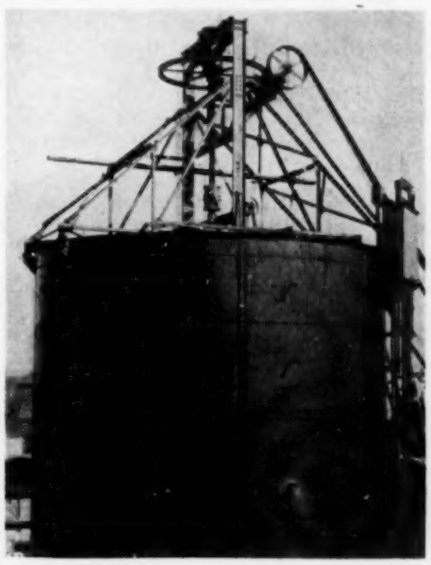
The Vallez Filter division of Joubert & Goslin is building a variation of the standard Vallez pressure filter which employs radial leaves instead of the usual disk type. This feature is said to give improved operation in some ways, as for example, better sluicing and far easier removal of filter elements. The filter consists of a pressure casing in which the filter elements revolve. A number of easily opened inspection doors permit quick removal and replacement of a leaking element without dismantling the filter. This is an obvious advantage. The elements are rectangular in shape and are disposed radially around a central shaft and parallel to its axis. This provides efficient agitation and insures a good cake. Radial leaf filters are built either with or without a helical conveyor in the hopper-shaped casing bottom for discharge of solids. The radial construction permits extremely thorough sluicing.

Another recent and radical departure in filters is the Hele-Shaw Stream-Line filter, a British product. There is as yet no similar filter on the American market. This employs the principle of edge filtration wherein filtrate percolates between tightly packed sheets of paper, while the solids are retained on the edges. It is believed that this is one of the most effective forms of ultra-filtration. Very remarkable clarification is possible. Stream-line filtration has been applied to a large variety of filters ranging from laboratory models to filter press plates, continuous vacuum leaf filters and water and oil filters of large capacity.



Vallez Radial Leaf Filter in Cross Section. Paddle-like Leaves Rotate Within a Casing

Both the paper and the cement industries have recently been introduced to vacuum filtration. Both drum and disk filters are being used. Oliver-United and W. D. Mount have led in the development of the filters in the paper industry. Here the filters are replacing gravity save-alls in the recovery of fiber from whitewater, and are being used in handling lime mud and washing pulp free from cooking liquors. In wet process cement plants, certain compositions of raw materials yield better results with less balling-up and much better fuel economy if the slurry is first considerably thickened by filtration. It may be expected that this use will spread.



Several Thickeners in Series, Built One Above the Other, Simplify Washing of Smaller Outputs in the Dorr Washing Thickener

Thickening

The use of thickeners of various types is rapidly being accepted throughout the chemical industry as a necessary adjunct to a filter installation where there is large volume of liquor to be handled. Similarly, when slimes and waste solids of all types are to be removed from large quantities of valuable liquid constituents, thickeners are now in order. The Dorr type of thickener is being built in ever increasing size so that a new form of drive for the plows has become necessary. This is a traction type in which the rake mechanism is propelled through a sweep drawn by a small motor-driven traction wheel running on the periphery of the tank. Another recent Dorr development is the washing thickener, a multiple tray machine which accomplishes in washing what would otherwise require a number of thickeners in series.

Two thickeners of the filter type have been put on the market by the now combined Oliver-United Filter Company. These are the Sweetland and the Oliver-Borden. Both consist of hopper-bottom tanks in which are suspended a considerable number of long tubular filter elements. Vacuum is applied to the ele-

ments to form a cake, after which the flow is reversed to detach the solids. The latter rapidly settle out and are withdrawn by a screw as a thick slurry. These thickeners find particular application in the beet sugar industry.

Another recently introduced thickener, somewhat similar in appearance to the Dorr, is the Hardinge thickener and clarifier. This uses a permeable filter bottom of graded, finely granulated material which is continually cleaned by a spiral rake. Liquor may also be discharged by a peripheral overflow. Settled material is discharged by means of the spiral rake along with a small amount of the sand filter bottom. This is particularly adapted to the recovery of liquids from waste solids.

Evaporation

In the field of evaporation, four tendencies are noted. There has been improvement in the Buffalo Foundry's type of inclined tube evaporator which permits the use of multiple effect. The principle which is so successful here, that of very high liquor velocity, is again evident in two new developments of the Swenson Evaporator Company. One is a new salt evaporator which abandons the standard type of central downtake construction for the basket type of heating element. Use of a propeller below the basket assures rapid circulation. The second new product is a positive, forced-circulation evaporator which employs an external pump for circulation. The heating element consists of a nest of long, small diameter, vertical tubes. This evaporator, because of its high heat transfer permits such a decrease in heating surface that special tube materials become practicable. For example, nickel tubes are used to great advantage in the caustic soda industry where this machine is rapidly displacing the standard vertical.

In evaporator operation, the principal change has taken place in the salt industry where continuous removal of salt is being practiced to some extent. This is accomplished by pumping a continuous stream of liquor and crystals from the evaporator, settling the crystals and separating them in centrifuges, and returning the mother liquor with fresh feed to the evaporator.

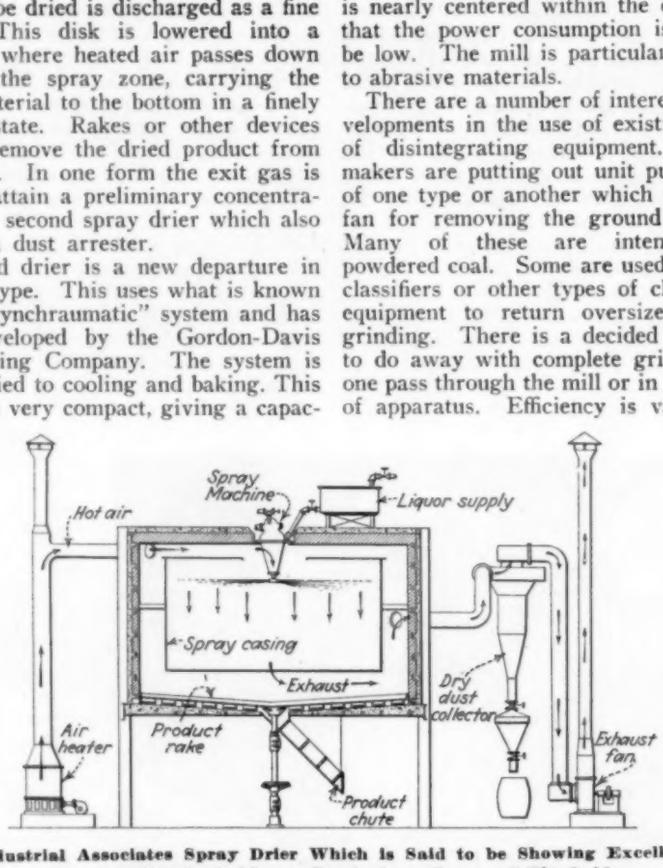
Drying

A number of new devices for drying both solutions and wet solids have created a good deal of interest. The kiln mill of Raymond Bros. Impact Pulverizer Company combines a source of hot gas or heated air with one of the standard Raymond mills. This permits the simultaneous grinding and drying of moist materials. The same device with slight modifications is used as an inert-atmosphere pulverizer for sulphur and other similarly combustible materials.

A new spray drier, a product of the Industrial Associates, has shown excellent results in drying tin oxide recovered from silk weighting washings, soap, glue, sodium sulphate, sodium silicate, lithopone and similar substances. It is understood that more complete information on this drier will be available shortly. Briefly, it consists of a small diameter spray disk rotated at 8,000 to 10,000 r.p.m., from the upper and lower surfaces of which the material to be dried is discharged as a fine spray. This disk is lowered into a chamber where heated air passes down through the spray zone, carrying the dried material to the bottom in a finely divided state. Rakes or other devices quickly remove the dried product from the drier. In one form the exit gas is used to attain a preliminary concentration in a second spray drier which also acts as a dust arrester.

A third drier is a new departure in the pan type. This uses what is known as the "synchraumatic" system and has been developed by the Gordon-Davis Engineering Company. The system is also applied to cooling and baking. This system is very compact, giving a capacity of as high as 2,400 per cent of a single belt conveyor drier. Its exterior radiating surface is comparatively small, but the surface of solids exposed in the pans is very large. The basis of the system is a multiple tray carrier unit which comprises a hinged frame to which are pivoted a number of equally spaced trays. The whole is mounted on wheels to run on angle iron track. A number of these units are operated simultaneously within the drier by a single mechanism which moves each filled unit into a storage space for easy contact with the heating, drying or cooling medium and removes it at the proper time, dumps the contents and returns the unit to the feeder for a new load.

Silica gel has taken a leading part in the drying of gases. Units are now available from the Silica Gel Corporation for drying many gases. These units provide a regenerative feature so that operation with dual absorbers is entirely continuous.



Industrial Associates Spray Drier Which Is Said to be Showing Excellent Results With Such Diverse Products as Soap and Tin Oxide

Disintegration and Deflocculation

Only one entirely new type of disintegrator has been observed. This is a segmental roll pulverizer made by the Brainard Pulverizer Company. Nine chilled iron segments of triangular shape are placed rather loosely within a rotatable casing. As the casing rotates, the segments slide and strike upon one another, acting upon the mill feed with a combination of pressure, impact and attrition. The weight of the segments is nearly centered within the casing so that the power consumption is said to be low. The mill is particularly suited to abrasive materials.

There are a number of interesting developments in the use of existing types of disintegrating equipment. Many makers are putting out unit pulverizers of one type or another which include a fan for removing the ground product. Many of these are intended for powdered coal. Some are used with air classifiers or other types of classifying equipment to return oversize for regrinding. There is a decided tendency to do away with complete grinding on one pass through the mill or in one piece of apparatus. Efficiency is vastly improved if the product is removed from the mill as fast as it is reduced to suitable size. This usually entails the removal of a considerable amount of oversize at the same time which must be returned for further grinding.

The compartment mill, sponsored in large part by Allis-Chalmers and now much used in the cement industry, aims at increased efficiency through the use of what amounts to a number of mills in series. Raymond and Hardinge mills usually attain the result by air separation. The Dorr classifier is finding increasing use in the chemical industry because of its application in return of oversize in wet grinding operations.

Haynes Stellite, on account of its extreme hardness, is now being welded to the wearing parts of disintegrators and increases their life very considerably. Another material of vastly different properties, rubber, is being employed for the same purpose in ball mills. Here it is used with much success as a lining material.

A new use for an old mill has been found in the paper industry where the rod mill has recently been used for pulping mill waste for lower grade papers.

Colloid mills are being used to an ever-increasing extent in many industries for deflocculating, dispersing and emulsifying. A newcomer in the colloid

mill field is made by the U. S. Colloid Mill Corporation. Here two flat rotors of annulus shape, instead of the conventional conical, tapered or pulley-like types, rotate in opposite directions with very close clearance. A hollow shaft serves as a feed or discharge pipe. The mill is subject to no pumping action and in fact requires a pump to circulate the feed, thus permitting material to be held for any desired time between the rotors. A decided advantage which is claimed is that with these two rotors, turning over at one-half the speed of a single rotor machine the disruptive action remains equal to that of the latter.

Mechanical Separation

Screening has witnessed no outstanding development, but rather a complete turn of very nearly the whole of the screen building industry to follow the lead of the makers of the original vibrating screen. There are a large number of vibrators now on the market, some of which operate by means of tappers or cams, some by eccentric rotating weights and some by magnetic means. Perhaps there is now a definite tendency toward the very rapid vibration of the entire screen rather than permitting flexing of the screen fabric which is frequently claimed to reduce the effective area of the screen and give greater wear.

In gyratory screens, the heavy-duty Rotex made by Orville Simpson Company shows an interesting improvement. Two balance wheels move in opposite directions and neutralize the forces due to gyratory and reciprocal movement of the screen so far as the reaction on the foundations is concerned. This feature is believed to reduce maintenance and vibration very materially and make it easily possible to hold a heavy screen on the foundations.

The air separation field has produced refinements but no decided changes in type or principle. The type containing an internal fan such as the Gayco and Sturtevant Whirlwind has been built in much larger sizes and adapted to give closer separation with less power consumption. The Hardinge and Raymond types appear to have changed little.

There has been some activity in the redesign of the old cyclone separator for dust removal purposes. The Sirocco separator, for example, produced by the American Blower Corporation, is a sort of attenuated cyclone, now considerably used for separating fly ash from pulverized fuel flue gases. Its efficiency is said to be not so much below that of the electrostatic precipitator of the Cottrell type. The latter is demonstrating widely increased use and penetrating such fields as acid concentration, general process dust recovery, cement mills, gas plants and zinc smelters.

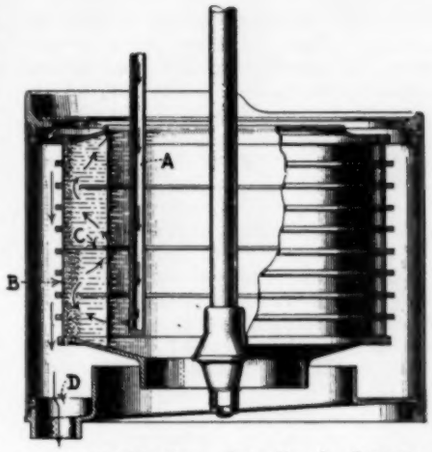
Centrifugal Separation

There are several interesting developments in the centrifugal separation field, although a good many of the manufacturers have devoted most of their energy to the perfection of machines for uses outside the chemical industry. In the high speed centrifugal class, two new Sharples machines have appeared, one of which, intended for lacquer clarification, is provided with a vapor seal and vapor connection to a receiver built as part of the unit. Another is inclosed in a vapor-tight casing and precludes the loss of explosive or corrosive fumes while it may be operated under moderate pressure or vacuum.

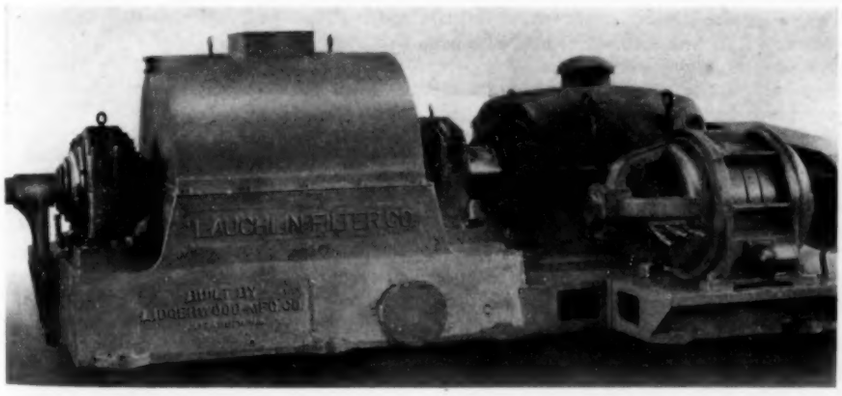
The Laughlin Filter Company has abandoned its original design of continuous centrifuge and is now building two new machines to process a wide range of materials. Each uses a horizontal low-speed bowl from which a scraper, rotating at slightly different speed, continuously removes the solids. One for coarse or fibrous material employs a screen for the bowl, while the other for slimes, clays or other finely divided solids uses a conical solid bowl in which a conical screw for solids discharge rotates with close clearance.

While the two machines are both intended for use with thickened materials and are not recommended for clarifying large volumes of liquids with small solids content, the screen type will handle larger amounts of filtrate. This machine may also be used for washing.

Two new types of clarifying centrifuges have recently entered the market. The "Positive," a product of the National Acme Company serves also as a separator. This machine is intended for such products as varnish and lacquer and employs a long narrow bowl containing tubes through which the treated material flows, depositing solids against the tube wall. A filter sleeve is provided if needed for further clarification. Almost diametrically opposed in design is the Resines centrifuge of Cresson-Morris. This is a large bowl, low-speed machine for clarifying sugar juices. It employs the baffling principle of the "Bac Portal" gravity settler to effect long travel of the liquor within the bowl. These baffles, consisting of annular rings of two different diameters within the bowl, force the liquor to travel a helical course from a point where it flows into the machine at the bottom, for several thousand feet to the discharge at the top, meanwhile being subjected to a force of 500 to 600 times gravity. Sedimented solids are easily flushed through the open bottom when they have accumulated sufficiently.



Large Clarification Capacity is Incorporated in the Resines Centrifuge Which Discharges Solids Simply by Stopping the Bowl



Continuous Discharge of Both Filtrate and Solids is the Principal Feature of the Laughlin Continuous Centrifuge. Two types, for Fine and Coarse or Fibrous Materials, are Made

Material Handling and Storage

No decided variations seem to have been introduced in material handling. There is, however, a strong leaning toward the use of anti-friction conveyor carriers. An improvement in rubber conveyor belts brought out by Goodyear increases flexibility for better operation at high speed by the elimination of all folds in laying up the fabric reinforcing. There has been a movement toward the bulk shipment of chemicals and other material through greatly increased use of pneumatic conveying. The advantages of this procedure are very great in the reduction of shipping costs and the virtual elimination of manual handling. The Fuller-Kinyon cement pump has made great strides in the cement industry. This is a screw-propelling device which moves the cement in an aerated condition. A system of automatic routing and blending of pulverized solids, developed recently by the Fuller Company, has likewise created considerable interest in the cement and allied industries.

The outstanding development in storage equipment is perhaps that worked out in connection with the petroleum industry by the Chicago Bridge & Iron Works. This is the Wiggins breather roof, a flexible metal roof

for tanks holding easily volatilized liquids. Vapor released as the tank warms up during the day need not be vented, but is accommodated by the expansion of the roof at its center. When cooler atmosphere causes condensation of the vapor at night the roof simply returns to its flat position.

Mixing and Agitation

Three new agitators and mixers for liquids or slurries have appeared. These are the Venturex mixer of Smith & Smith, the Hill Clutch Machine and Foundry Company's tubular agitator and the Dorr Impeller agitator. Each employs a propeller for positive circulation. The first is built in the form of a vertical Venturi with the propeller in the throat. It is especially designed for cement slurries. The second and third employ vertical draft tubes, the second of constricted section at the propeller and the third of constant section. The first two have annular openings at several levels for intermediate mixing. The last employs a rake for sweeping settled materials below the draft tube and into the path of circulation.

Robinson Company has introduced a dry mixer for such materials as dry colors in which helical flights provide the mixing while shoes which bear upon the casing at the bottom and sides crush out any lumps. J. H. Day Company is making an experimental mixer and kneader in which the two agitators may be easily reversed for different mixing effects or removed and replaced by agitators of a different design.

Heating and Heat Transfer

There do not appear to be any very marked changes in furnace construction, although better refractories such as chrome, magnesite, silicon carbide, alumina, carbon, silica and mullite have gained much ground. It is now frequently appreciated that the more expensive refractories are usually the cheaper in the long run. There are also new furnace applications. Silica brick is being fired in tunnel kilns; rotating kilns are finding increased use in the lime industry; ceramic ware manufacturers are abandoning periodic kilns in ever greater numbers in favor of continuous tunnel apparatus.

A new type of heating has been introduced by the National Electric Heating Company which makes use of the resistance of the processing container in generating electric heat. This principle has been applied tc liquid heaters, oil stills, varnish systems, paper rolls, kettles and evaporators and presents such advantages as close control, no fire hazard, cleanliness and high heat transfer. There is also the elimination of hot spots with the consequent danger of burning the product. Contrary to what would seem to be the case, this system is said to be comparatively low in cost to operate as it uses low voltage and a doubling back of the circuits which gives minimum self-inductance and a favorable power factor.

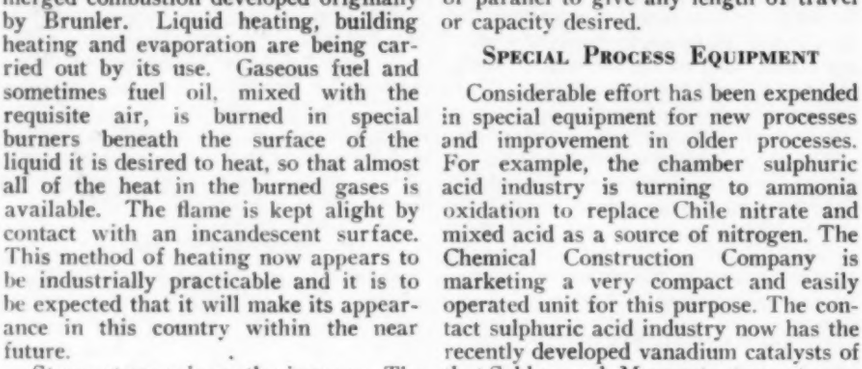
Another type of heating which is now being employed in England and to some extent in Germany is the system of submerged combustion developed originally by Brunler. Liquid heating, building heating and evaporation are being carried out by its use. Gaseous fuel and sometimes fuel oil, mixed with the requisite air, is burned in special burners beneath the surface of the liquid it is desired to heat, so that almost all of the heat in the burned gases is available. The flame is kept alight by contact with an incandescent surface. This method of heating now appears to be industrially practicable and it is to be expected that it will make its appearance in this country within the near future.

Steam storage is on the increase. The Ruths system is finding application in pulp mills and the Smoot accumulator in the gas industry. The former is a high and the latter a lower pressure system. Accumulators dissolve surplus steam under pressure in water, from which the steam flashes when an increased demand reduces the pressure. This action is ordinarily governed entirely automatically. The use of the high pressure type permits short overloads of very great magnitude to be carried without pushing the boilers unduly. The system also will carry a varying demand with constant boiler load.

There are a number of interesting new pieces of heat transfer equipment. The Leach Fracto Condenser, made by the C. H. Wheeler Company is a condenser column in which various fractions, which may be cooled with cooling media at different temperatures are recovered separately. This is used principally in the petroleum industry. Two new devices have been introduced by the Griscom-Russell Company. One, the "Bentube" cooler employs initially curved tubes which change their curvature with temperature variations and prevent the clinging of scale. The other, known as the "Tubeflo" section is a heat-exchanger unit with passages for hot and cold fluids cast integral. Numbers of the units are jointed in series or parallel to give any length of travel or capacity desired.

Special Process Equipment

Considerable effort has been expended in special equipment for new processes and improvement in older processes. For example, the chamber sulphuric acid industry is turning to ammonia oxidation to replace Chile nitrate and mixed acid as a source of nitrogen. The Chemical Construction Company is marketing a very compact and easily operated unit for this purpose. The contact sulphuric acid industry now has the recently developed vanadium catalysts of the Selden and Monsanto types to replace the more expensive and easily poisoned platinum catalyst masses. It is understood that silica gel is being used as a base for platinum contact masses.



New Drum-type Concentrator for Sulphuric Acid Developed by the Chemical Construction Company

The Chemical Construction Company has developed something new in a sulphuric acid concentrating system. This is applicable either to the concentration of fresh acid or the recovery of refinery sludge acid. Known as the drum concentrator it consists of a 3-compartment drum. The first compartment is lined with refractories and serves as a combustion chamber for oil or gas where excess air from a fan is heated. The hot gas and air at about 1,100 deg. F. then pass to the second and third chambers through which the acid flows counter to the gases. The gases enter through special distributors beneath the acid surface and leave the system through a fume separator such as the Cottrell. Particularly good heat efficiency is one of the claims made for the new process. The process is continuous and requires little labor. Several methods are used for separation of the sludge. These include open tank and pressure methods, where in any case the sludge is treated with steam, causing a separation when the mixture is dropped to a settling tank.

Two interesting devices have been put on the market by Max B. Miller & Co. The first, called the "Samplitt" intermittently and automatically extracts representative samples of liquids in any desired amount from any pipe line under slight pressure. The second device, which is, except for slight changes, a Samplitt run backwards, is called the "Mixitt" and is used to add any sort of reagent continuously to the contents of pipe lines.

A new tower packing by Maurice Knight, called the "Hexahelix," offers attractive advantages. This is a spiral ceramic packing of hexagonal perimeter, which shape eliminates the space between units inherent in ring packing and prevents straight gas flow. The central hole characteristic of some spiral packings, is likewise eliminated for the same purpose.

The Vorce cell for electrolytic production of caustic soda has made considerable impression on the caustic industry. This is a vertical cylindrical cell of simple and light construction, easily built and easily repaired. Particularly high current efficiency and exceptionally pure chlorine and hydrogen are said to be among its advantages.

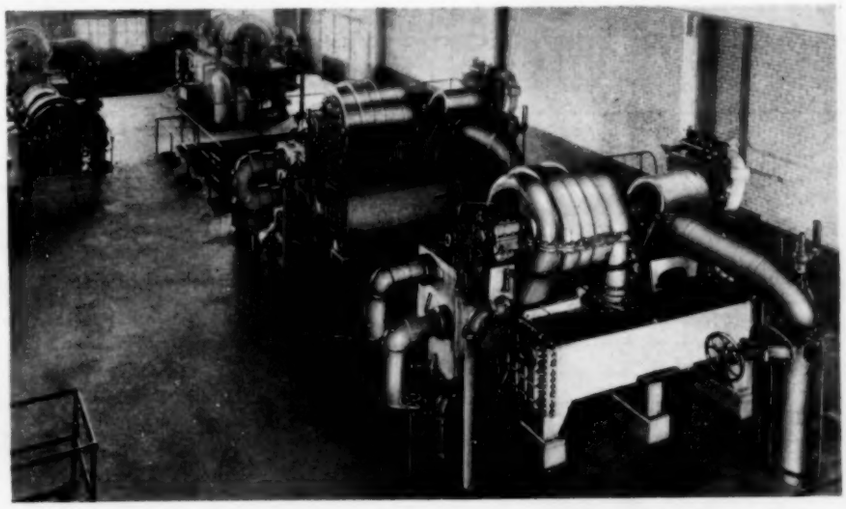
The city gas industry is undertaking to mechanize its production. Hence considerable equipment has been produced and is being extensively used for automatic water-gas and oil-gas generation. These machines are completely automatic from feed to ash discharge. In the coal-gas field increased efficiency is being attained with vertical retorts which have been applied to some extent. In all cases, labor requirements are much reduced. Another source of economy is the dry quenching of coke which eliminates a nuisance and increases efficiency. Gas distribution shows a trend toward higher pressures and longer distances of transmission, both of which causes are much assisted by the use of welding for pipe joints. In storage, the spherical pressure holder has come into being and there is a marked increase in the use of the "waterless" type of holder. During the year, the largest such holder ever built, 20,000,000 cu.ft. capacity, was put in service at Chicago.

Instruments

Many new developments have been made in the sphere of indicating, recording and controlling instruments of all kinds. As the subject of instrumentation will be treated at considerable length in a series of articles to appear in subsequent issues of *Chem. & Met.*, little need be said now on the subject. Mention should be made, however, of the present widespread use of automatic controlling devices for nearly every conceivable use. These controls interest the chemical engineer principally in connection with pressure, temperature, humidity, liquid level, flow and specific gravity. There are also controlling and indicating devices for gas composition. Several indicating instruments for materials rather than for conditions will bear mention at present. A sensitive methane detector has been evolved by the Union Carbide & Carbon Corp. A detector for mercury vapor is the product of the General Electric Company, while the Mine Safety Appliances Company has brought out a continuous indicator for showing concentration of flammable vapors of all kinds.

Other Unit Processes

In the field of refrigeration, ammonia is still holding its own, although carbon dioxide and other refrigerants are coming into use. An important new piece of equipment is a unit refrigerating system produced by the Carrier Engineering Company. This is a centrifugal system employing pressures which are all below atmospheric. The refrigerant in this case is an organic compound called "Carrene."



Carrier Unit Refrigerating Apparatus Uses an Organic Refrigerant Circulated at Sub-atmospheric Pressures by a Centrifugal Pump

Several new pumps for various liquids have appeared, of which the Kinney Heliquad is perhaps the most novel. This is a gear type pump, in which, however, the usual type of gear is replaced with double helical gears with teeth extending over 120 deg. of gear circumference. This arrangement is said to give a pulsationless discharge. Among other liquid handling equipment, there are a number of new electrically operated valves, indicative of the present tendencies in automatic control. These are also used for remote manual control.

Auxiliary Equipment

Welding for all types of process equipment appears to have come into its own. Gas welding, arc welding, atomic-hydrogen welding, hammer welding and forging are all being used, the first two to a very considerable extent.

In the field of fire protection, several companies have put out carbon dioxide systems which are especially effective in many chemical fires of one kind or another, particularly where water cannot be used. Further advantages lie in the speed with which fires are extinguished and the absence of any after-effect due to the fire-fighting medium.

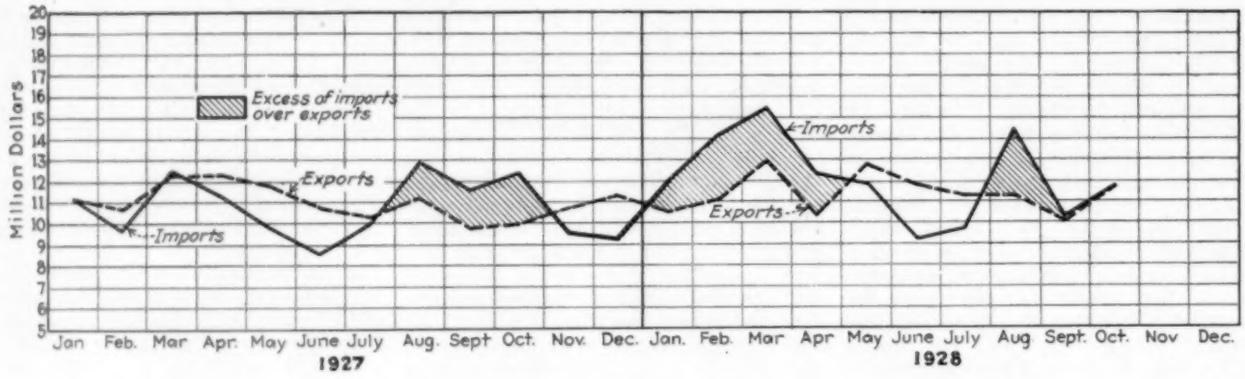
There are now several very effective air filters on the market, some of which rely upon a baffling effect and the trapping of dust in oil, while others employ a fibrous cellulose filter medium or filter cloth. Humidifying systems and air conditioning units have been highly developed and show a tendency toward decentralization, that is, the use of unit apparatus. A similar trend is apparent in heating as there are now a great number of makes of unit heaters available. All of these employ extended surface radiation and are usually equipped for forced draft.

Power transmission equipment shows markedly that the present preference in most industries is for individual motor drive whenever possible. Speed reducers have been rendered most dependable and highly efficient. Flexible couplings in great profusion are offered. There are also a number of infinitely variable speed changers of types ranging from the elaborated belt and cone pulley type to a number of drives which are, in principle and inherently, entirely positive in operation.

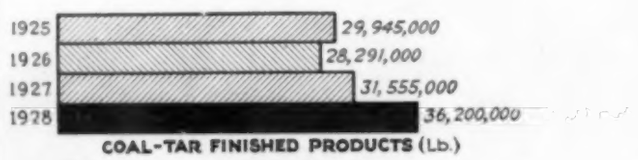
This same trend toward individual motor drive is reflected also in the motors themselves. The small motor of a few horsepower has received much attention. The trend is also shown by the number of perfected control devices which have appeared. One type, the thermal overload relay, is a good example. This cuts out a motor in case of overload only when the condition has lasted long enough to injure the motor by heating.

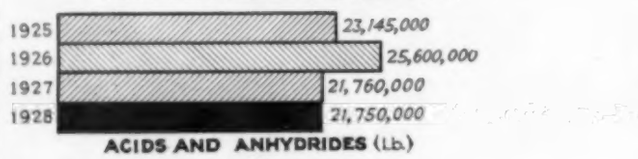
Practically every motor manufacturer now builds at least one fully inclosed dust-proof motor, some ventilated from an outside source and some with a self-contained fan. A number of manufacturers are building motors for explosive service, usually employing the broad flange type of construction. Finally, recognition of the need for power factor correction is on every hand for synchronous motors and condensers have become very popular with the man who pays the power bills.

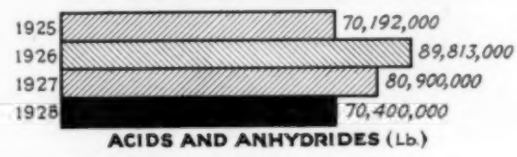
IMPORTS *and* EXPORTS *of Chemical and Allied Products*, 1927-1928

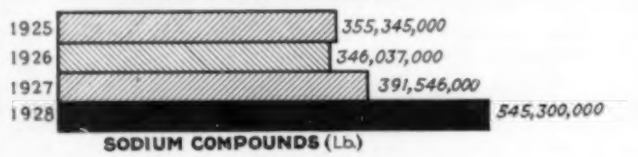


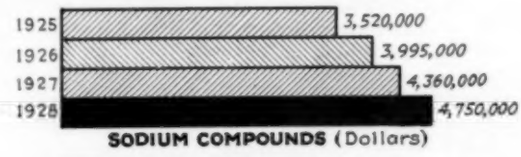
FOREIGN TRADE IN CHEMICALS

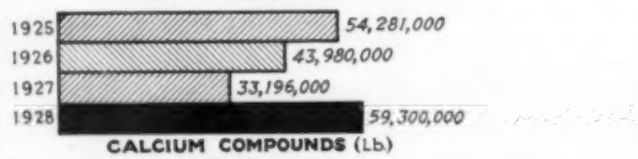


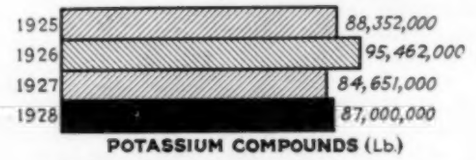


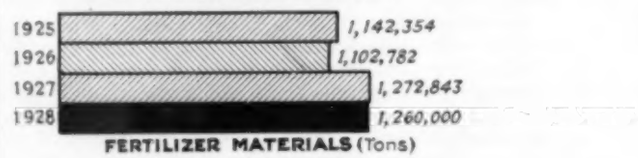


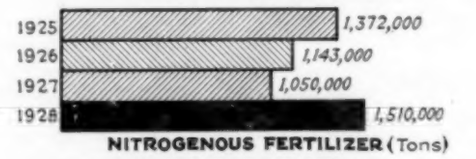


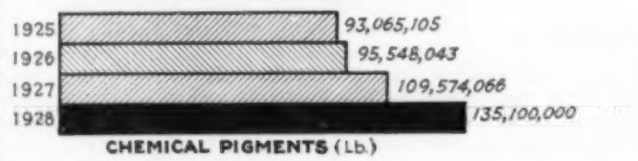


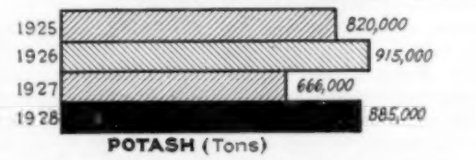


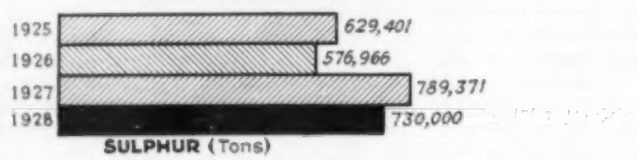


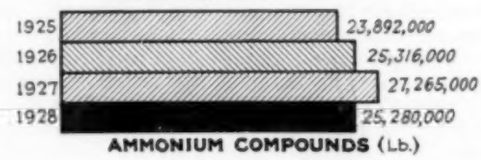


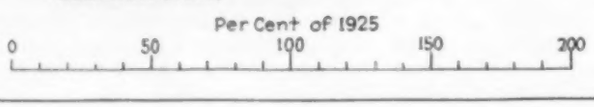


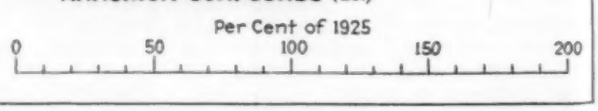




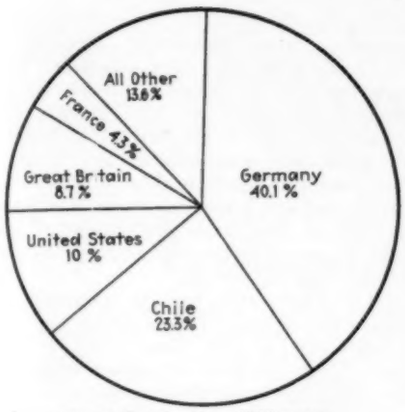








Nitrogen Holds Premier Position Among World Developments



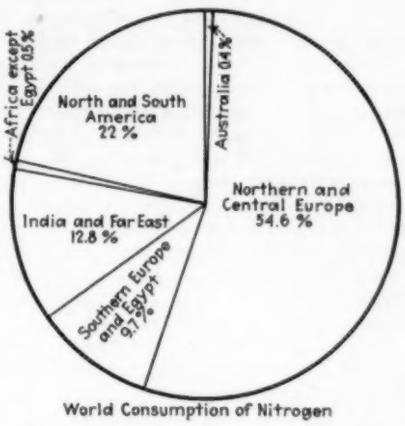
World Production of Nitrogen

FOR the calendar year 1928, the estimated world production of nitrogen is 1,844,000 short tons, distributed according to Table I. Of this quantity, 437,300 tons or 23.7 per cent was produced in byproduct coke ovens; 976,900 tons or 53.0 per cent was produced by the various synthetic processes; and 429,800 tons or 23.3 per cent was produced as Chile nitrate. Germany produced about 740,000 tons of nitrogen, or 40.1 per cent of the world production; Chile produced 23.3 per cent; the United States produced 10.0 per cent; Great Britain produced 8.7 per cent and France produced 4.3 per cent. Thus, the five largest producers accounted for 86.4 per cent of the world production, and twelve other countries for which approximate statistics are available, produced the remaining 13.6 per cent.

In Table II there is presented the comparative world production of nitrogen for the fertilizer years 1926-27 and 1927-1928, as estimated by the British Sulphate of Ammonia Federation, Ltd. This table shows a marked increase in the production of all forms of nitrogen, the greatest percentage increase being that of Chile nitrate, namely 95.3 per cent, whereas the smallest percentage increase was 9.5 per cent that of cyanamide. The total production of nitrogen increased 34 per cent in the year 1927-1928 over that of 1926-1927.

The world consumption of nitrogen for the fertilizer year 1927-1928, as estimated by the British Sulphate of Ammonia Federation, Ltd., is shown in Table III. Of the total consumption of 1,763,400 short tons, 1,133,500 tons or 64.2 per cent was consumed in Europe and Egypt; 225,000 tons or 12.8 per cent was consumed in Asia; 9,000 tons or 0.5 per cent was consumed in Africa (excluding Egypt); 389,000 tons or 22.1 per cent was consumed in the Americas; and 6,100 tons or 0.4 per cent was consumed in Australasia. A striking feature shown by Table III is the dominant position of sulphate of ammonia as compared with other forms of nitrogen, particularly nitrate of soda and calcium cyanamide.

AN OUTSTANDING event of the year was a second international conference held aboard the steamer Lützow, April 30 to May 10, while sailing the Adriatic. Representatives of fourteen countries interested in nitrogen production and nitrogen consumption were present and all are reported to be substantially in agreement as to the need for further research and for propaganda favoring enlarged agricultural use of nitrogen fertilizers. The resolutions adopted urged sound economic development on the part of the producing industry, comprehensive research by agriculture, and the encouragement by governments of greater nitrogen use.


Africa except Egypt 0.5%
North and South America 22%
Australia 0.4%
Northern and Central Europe 54.6%
India and Far East 12.8%
Southern Europe and Egypt 9.7%

World Consumption of Nitrogen

All of these efforts combined will doubtless produce growth in the nitrogen requirements of the world; but it is not evident just how they are going to be sufficiently effective to insure a market for the quantities of nitrogen which it is forecast will be available within a few years. Some of these forecasts indicate that the world supply of nitrogen by 1931 or 1932 will be in excess of 3,000,000 net tons per year, a total more than double the consumption of the fertilizer year 1926-27.

Table I. Estimated World Production of Nitrogen for 1928

(Short Tons of Nitrogen)

Country	Rank	Nitrogen from Coke Ovens	Nitrogen from Synthetic Processes	Total Nitrogen Produced, Short Tons
Germany	1	100,000	640,000	740,000
Chile	2	.....	.....	429,800
United States	3	160,300	24,000	184,300
Great Britain	4	100,000	60,000	160,000
France	5	25,000	55,000	80,000
Italy	6	4,000	44,000	48,000
Poland	7	3,300	34,500	37,800
Canada	8	6,000	31,300	37,300
Japan	9	5,000	28,600	33,600
Norway	10	.....	33,000	33,000
Belgium	11	15,000	10,000	25,000
All other countries		18,700	16,500	35,200
Total world production short tons		437,300	976,900	1,844,000

Table II. World Production of Nitrogen for the Fertilizer Years 1926-1927 and 1927-1928, as Estimated by the British Sulphate of Ammonia Federation, Ltd.

(Converted to Short Tons of Nitrogen)

	Fertilizer Year 1926-1927	Fertilizer Year 1927-1928
Byproduct sulphate of ammonia	334,000	370,000
Synthetic sulphate of ammonia	330,000	403,000
Cyanamide (excluding cyanamide in Japan, which is included under synthetic sulphate of ammonia)	198,000	217,000
Nitrate of lime	89,000	111,000
Other forms of nitrogen from synthetic processes (includes aqua ammonia)	147,000	232,000
Other forms of byproduct nitrogen (includes aqua ammonia)	44,000	61,000
Chile nitrate	220,000	430,000
Total production, short tons	1,362,000	1,824,000

Table III. World Consumption of Nitrogen for the Fertilizer Year 1927-1928 as Estimated by the British Sulphate of Ammonia Federation, Ltd.

(Converted to Short Tons of Nitrogen)

	Ammonium Sulphate Equivalent	Chile Nitrate	Calcium Cyanamides	Other Forms of Synthetic Products	Total Consumption, Short Tons
Scandinavia, Russia, Baltic States, Germany, United Kingdom, Holland, France, Switzerland Austria, Czechoslovakia, Hungary, Roumania, Jugoslavia and Bulgaria	381,000	158,000	171,000	252,000	962,000
Spain, Portugal, Azores, Madeira, Italy, Sicily, Egypt and other Mediterranean countries	74,000	64,500	16,000	17,000	171,500
Indian Empire, Ceylon, Philippines, Straits, Dutch East Indies, Siam, Borneo, Japan, Korea and China	b197,000	14,500	b11,500	2,000	225,000
Africa (excluding Egypt) and neighboring islands	2,800	6,000	.....	200	9,000
United States, Canada, Central and South America, West Indian Islands and Hawaii	157,000	185,000	18,000	29,000	389,000
Australasia	4,000	2,000	.....	100	6,100
Total consumption, short tons	816,800	430,000	216,000	300,300	1,763,400
Comparative figures for fertilizer year 1926-1927	720,000	303,000	199,000	222,000	1,444,000

a Ammophos is included under calcium cyanamide.
b Japanese calcium cyanamide is converted into ammonium sulphate and is included in the latter figures.

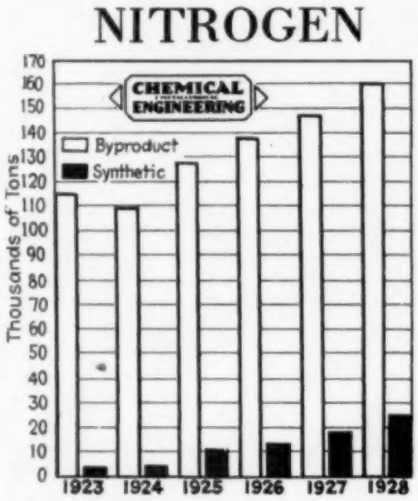
Increased Output, Import, and Use of Nitrogen in U. S. in 1928

NITROGEN production, nitrogen import, and nitrogen consumption in the United States all increased by large percentages during 1928 as compared with 1927. Nitrogen exports during the corresponding period fell off substantially; and the United States for the first time since the war imported considerably greater amounts of ammonia nitrogen than it exported. The imports of other nitrogen compounds, particularly Chilean nitrate, also increased largely during the year. The tables and charts accompanying this report summarize the most important figures which show these trends.

Domestic production of nitrogen compounds now accounts for approximately 40 per cent of the apparent total supply of nitrate and ammonia nitrogen compounds. About 5 per cent, that is one-eighth of domestic production, comes from synthetic ammonia plants which produced during 1928 one-third more anhydrous ammonia than in the preceding year, thus establishing a new production record. The bulk of domestic ammonia production occurs at byproduct plants, principally byproduct coke works.

Of the total nitrogen supply of the country almost 60 per cent is imported, about two-thirds as Chilean nitrate and one-third as cyanamide, ammonium salts, and other miscellaneous nitrogen compounds. It is particularly surprising to note the fact that there is now more nitrogen imported as ammonium sulphate or ammonium sulphate-nitrate than is exported as ammonium sulphate. Thus the United States has returned, at least temporarily, to its pre-war status as an importer of ammonia compounds.

SYNTHETIC ammonia plants which were operating at the close of 1927 continued production through 1928, in most cases at somewhat increased capacities. One new plant, at Hopewell, Virginia, began operation during December; the other plants regularly operating are located at Syracuse and Niagara Falls, N. Y., Belle, W. Va., Seattle, Wash., and Pittsburgh, Calif. The total output of direct synthetic ammonia at these plants is estimated to have been 24,000 tons of nitrogen, equivalent to 29,000 tons of ammonia, during 1928. The capacity of these plants already completed or nearing completion is now in excess of 350 tons of ammonia per day, or 125,000 tons of ammonia per year. It is to be expected, therefore, that the 1929 production of synthetic ammonia in the United States will greatly exceed that of the past year. Some optimistic forecasters estimate that the production will be more than three times that of 1928.



Chem. & Met. Estimates of U. S. Production

As a consequence of the rapid increase in synthetic ammonia production it is evident that the industrial requirements will be greatly exceeded, including the needs for ammonia oxidation in the sulphuric acid and nitric acid industries. Hence, much of the nitrogen fixed by these plants must presumably find its outlet for fertilizer use, which accounts for the plan to convert most of the ammonia made at the new Hopewell plant into sodium nitrate, synthetic Chile saltpeter.

BYPRODUCT ammonia production at coke works continued to grow during 1928, about in proportion as the output of coke increased. Thus it is estimated that there was about a 9 per cent increase in ammonia production at these plants above the 1927 production. There was also some increase in output of byproduct ammonia at gas works; but even the substantial percentage increase which occurred there does not amount to any large percentage of the total from all byproduct sources in the United States.

It is likely that further increases in byproduct ammonia production in the United States will occur only as the use of coke ovens is expanded to supply city gas, since the present metallurgical coke market is apparently adequately provided for with present installations, and new construction is likely to occur principally to replace old and inefficient equipment rather than for the purpose of enlarged coke-making capacity. As a consequence, it is growing to be the general feeling that increases in byproduct ammonia output in the United States will be small in percentage for some years to come.

The deficiency in nitrogen production to meet the total requirements of the United States continues to be supplied largely by imported Chilean nitrate; but, as indicated above, imports of other nitrogen compounds assumed largely increased importance during the past year, amounting in terms of nitrogen content to nearly three times the total imported in 1926 and 50 per cent more than in 1927. Importations of Chile nitrate doubtless will continue at the rate of at least 150,000 short tons of nitrogen per year, and likewise considerable nitrogen will be imported from Germany, due to the fact that the prices of nitrogen in the United States can decline to much lower levels before either Chile nitrate or German nitrogen must be sold at a loss.

CONSUMPTION of nitrogen compounds undoubtedly increased greatly during 1928. But it seems very unlikely that the apparent United States

Sources of Chemical Nitrogen Used in the United States, 1926, 1927 and 1928

(Quantities in Net Short Tons of Nitrogen Contained)

	1926	1927	
Production:			
At coke works	142,300	147,700	160,700
At gasworks	6,400	6,200	6,500
From the air	12,800	18,000	24,000
Bone distillation, etc.	200	200	200
Total production	161,700	172,100	191,400
Imports:			
Chile nitrate	160,000	130,000	190,000
Calcium cyanamide	21,000	26,000	33,000	
Ammonium sulphate nitrate	.....	13,000	28,000
Ammonium sulphate	1,900	3,900	7,000
Calcium nitrate	2,400	3,100	4,000
Nitrogeneous fertilizer mixtures (estimated)	5,000	6,000	8,000
Cyanides	4,600	4,800	5,300
Miscellaneous ammonium salts and nitrates	4,500	4,600	4,900
Total imports	199,400	191,400	280,200
Grand total available	361,100	363,500	471,600
Exports:			
Ammonium sulphate	41,800	32,400	23,000
Sodium nitrate	1,400	2,200	3,500
Anhydrous ammonia	400	500	800
Other nitrogen compounds	2,200	2,000	2,000
Total exports	45,800	37,100	29,300
Apparent U. S. Consumption	315,300	326,400	442,300

Disposition of Chemical Nitrogen in U. S. Estimated For the Calendar Year 1928

(Short Tons of Nitrogen Contained in Nitrates and Ammonia Compounds)

Industrial Use:	
Nitric acid manufacture (from Chile nitrate and ammonia, including requirements for chamber acid plants)	43,000
Refrigeration	14,000
Explosives (as Chile nitrate and ammonia, but excluding requirements for nitric acid manufacture)	22,500
Cyanides manufacture	9,500
Soda ash manufacture	4,000
Miscellaneous ammonium salts and nitrates	4,000
Aqua ammonia for miscellaneous purposes	6,000
Chile nitrate for miscellaneous purposes	11,000
Total non-fertilizer consumption	114,000
Apparent consumption in fertilizers, including increases in stocks on hand	328,300
Total apparent consumption	442,300

consumption was as much as 442,000 net tons of nitrogen, as is indicated by deducting exports from the total of production and imports. As a matter of fact, it is known that the stocks of nitrate have increased somewhat in the United States and it is likely that the actual consumption of nitrogen was not much over 400,000 tons. The general industrial uses for which estimates are given account for approximately 25 per cent of the total apparent consumption, leaving for fertilizer uses three-fourths of the total available nitrogen produced or imported.

It is of interest to note that nitric acid manufacture, including chamber sulphuric acid plants, used 10 per cent of the total United States nitrogen and that explosives making, other than nitric-acid manufacture, accounts for fully 5 per cent of the total. These two requirements are, therefore, 60 per cent of the industrial requirements for chemical nitrogen or 15 per cent of the total nitrogen consumption.

Production Increase Greater Than Needs for Consumption of Chile Nitrate

CHILEAN nitrate production continued to grow during 1928, in fact, exceeded the consumptive capacity of the world by a substantial amount. As a consequence the visible world stocks of Chilean nitrate at the end of 1928 were approximately 500,000 metric tons above corresponding stocks a year before. The latest official report on this point is that for the end of October, 1928, at which time there were reported to be visible stocks of 1,840,000 metric tons. The number of oficinas in operation increased during the calendar year from 62 to 69. It is notable also that the oficina "Maria Elena" (the Guggenheim property) increased its rate of production from 15,000 tons to about 32,000 tons per month.

The United States imports of Chilean nitrate during the year were about 30 per cent greater than during the preceding calendar year, but almost exactly equal to the average imports for the four-year period 1923 to 1926. It is evident from these facts that the United States is tending to stabilize its consumption at approximately 1,000 long tons of Chilean nitrate per year, roughly 40 per cent of the maximum recent world consumption.

It is also evident that if the Chilean nitrate industry does not stabilize its rate of production at some point between 2,000,000 and 2,500,000 tons per year it will probably continue to build up further unwarranted stocks on hand and establish a basis for another crisis in its own affairs due to frozen credits and excessive supplies of nitrate above current needs. The only apparent justification for the very large production of nitrate in 1928 is the fact that by this large production the industry made up for the deficiency in production below normal which occurred during the preceding year. However, this result has been achieved at the expense of enlarged stocks, certainly now equal to the maximum world need and probably substantially in excess of the real requirements for stabilization of the trade.

Two outstanding market developments occurred in the Chilean nitrate business during the year, (a) the re-establishment of "free selling" and (b) the provision for governmental aid by Chile. Apparently the first of these factors has actually been beneficial to the industry in permitting a real competition between Chilean nitrate and byproduct and synthetic ammonia. Even at the reduced prices which have prevailed recently the more efficient producers can apparently obtain real profit above costs of delivery f.o.b. New York. Prices in Europe, as well as in the United States, receded sharply during the year, quotations on the Continent dropping by about 17 per cent, from £12 14s per long ton in the spring of 1927 to £10 10s at the corresponding season in 1928.

The delivered cost of Chilean nitrate will be still further reduced whenever the Chilean government's bonuses to producers take effect. The subvention announced during the year will afford payments equal at least to 10 per cent of the present export duty and larger percentages whenever the exports exceed 2,150,000 metric tons per year. Other aids accorded to the nitrate producers by Chile included reduction in import tax on nitrate bags, a system of deferred payments of export taxes, and rental instead of outright sale of nitrate lands. The promise to afford further relief to nitrate producers whenever the price of synthetic ammonia products is reduced by European producers ensures considerable stability in present profits, provided the hazard of excessive nitrate stocks, with its attending possibility of ruinous competition, can be avoided.

Productions, Exports and World Consumption of Chilean Nitrate

(Data for Calendar Years Except Consumption Figures Which Are For Fertilizer Years Ending June 30.)

	Production (Thousands of Metric Tons)	Exports from Chile (Thousands of Metric Tons)	Imports Into United States (Thousands of Long Tons)	World Consumption (Thousands of Metric Tons)
1922	1,072	1,313	542	
1923	1,906	2,266	892	2,159
1924	2,403	2,363	986	2,192
1925	2,520	2,517	1,112	2,340
1926	2,016	1,614	914	2,092
1927	1,611	2,375	748	1,774
1928	3,100	2,700	1,000	2,500

All data from United States Department of Commerce except world consumption figures which are those of the British Ammonium Sulphate Federation.

German Nitrogen Industry Continues to Expand

FOR the calendar year 1928, the Haber-Bosch plants at Oppau-Merseburg are estimated to have produced 540,000 short tons of nitrogen, and the production of the calcium cyanamide plants at Piesteritz-Trostberg should be nearly 100,000 short tons of nitrogen, or an increase of nearly 20 per cent over the 1927 production. It is reported that the power consumption in cyanamide manufacture is now only 60 per cent of that in 1924, which may account for the increased output of cyanamide despite the magnitude of the Haber-Bosch process operations. Pure hydrogen gas is said to be produced at a cost of not more than 20 cents to 25 cents per 1,000 cu.ft. at the Merseburg plant, due to a recent development in power gas manufacture, whereby pulverized brown coal is gasified at the mines, the producer gas and blow-run gas being conducted through pipes to the works 15 miles distant.

The Rauxel, Westphalia, plant of the Kloeckner Coal Company of Dortmund and the Kali-Industrie A.G. of Cassel commenced operations in September. In this plant, known as the Gewerkschaft Victor, ammonia is synthesized by the Claude process, using coke-oven gas.

The first unit of the Mont Cenis-Hibernia plant at Sodingen, Westphalia, is reported to have been ready for operation during the latter part of 1928. This plant, which uses the Uhde low-pressure process, also utilizes coke-oven gas. The production is to be sold by the Nitrogen Syndicate.

Ruhr-Chemie A.G., which was incorporated in October, 1927, as "Kohle-Chemie A.G.," made distinct progress in 1928. It will be recalled that Kohle-Chemie A.G. was formed by 27 of the leading coal producers of the Ruhr, for the purpose of utilizing coke-oven gas by the synthesis of ammonia.

Although the Ruhr-Chemie produces coke-oven gas equivalent to 1,200,000 tons of nitrogen per year, only part of the gas is available for ammonia synthesis. It is estimated that 50 per cent of the gas is used for heating ovens, 15 to 20 per cent is used in steel plants, 15 to 20 per cent is burned under boilers, the remainder of 10 to 20 per cent being sold for domestic distribution. Therefore, the actual quantity of gas immediately available for ammonia manufacture is that burned under boilers, equivalent to at least 180,000 tons of nitrogen annually. The initial ammonia project, comprising three 20-ton Casale units, using the Concordia-Linde liquefaction process for hydrogen production, was under construction in the early part of 1928 and should be completed during 1929. Ruhr-Chemie is a member of the Stickstoff Syndikat and therefore the output is limited, at least for the present. Considering the vast resources of Ruhr-Chemie, it is not reasonable to suppose that this new but powerful combine will remain a small factor in the German nitrogen industry.

Record-Breaking Production Characterizes Coal Products in 1928

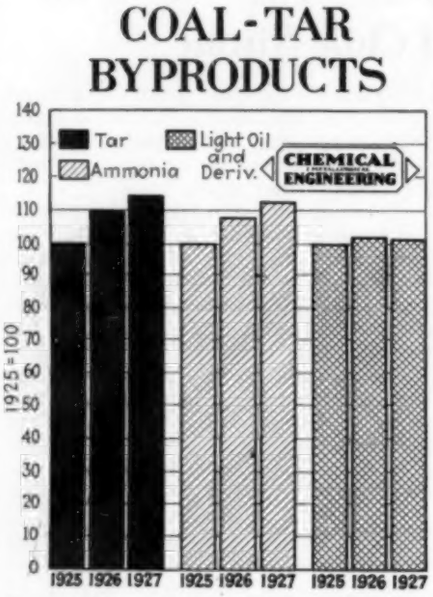
By R. S. McBride
Assistant Editor, Chem. & Met.

BYPRODUCT COKE OVENS of the United States established numerous new production records in 1928. The output of coke, gas, light oil, tar, and ammonia exceeded in volume the output of any preceding year in history, being 9 per cent greater than during 1927 and 7 per cent greater than the largest previous production, that of 1926.

Beehive coke ovens, on the other hand, had the lowest production recorded in any year since 1881, the output of beehive coke being barely 60 per cent of that of 1927. The combined production of beehive and byproduct coke was 2.5 per cent greater than in 1927. It is evident, therefore, that the byproduct oven activity was more than sufficient to offset the continued further decreases in beehive oven business. In no month during the year did beehive ovens produce as much as 10 per cent of the coke made; and for a period just after the middle of the year the beehive ovens accounted for barely 6.5 per cent of the total coke made. The average for the year was 91.5 per cent of the coke from byproduct ovens and 8.5 per cent from beehive ovens.

Several important factors in coal products markets have contributed to the stimulus given to the byproduct oven industry. Among these factors are the following:

1. Use of coke for household fuel is slowly, but none the less certainly, increasing. This development, especially marked in certain areas where anthracite was formerly very popular, is affording real opportunity for sound economic development of coke-oven plants which have hitherto been impractical because the coke markets were not yet adequately developed.



Percentage of 1925 Production (Estimate by U. S. Bureau of Mines)

2. Renewed industrial activity reflected by increased demand for steel has occasioned enlarged operations in numerous metallurgical coke plants.

3. Increased demand and prospective demand for the primary products of tar refining have led to more favorable prices for oven tar. The same reason has undoubtedly been largely instrumental in influencing the U. S. Steel Corporation to establish at its Clairton, Pennsylvania, coke works one of the largest tar refining plants of the country and the first such large plant directly connected with metallurgical coke.

4. The desire of city-gas companies to substitute coal gas as a base load for any other source of supply has created additional demands for coke-oven gas. This has led to the firing of more ovens with other gases and the decision to use blast-furnace gas in two plants for underfiring of ovens, making all of the oven-gas production available for sale to the city-gas works.

5. The market for ammonia liquor which practically disappeared a year ago is again showing evidence of very favorable developments, viewed from the standpoint of the small byproduct oven plant operator who cannot afford to make ammonium sulphate because of the large investment and the large operating expense involved in works of such size. This new liquor market has been created as a result of the successful use of ammonia liquor for neutralizing superphosphate fertilizer. In this application ammonia liquor supplants calcium cyanamide. (This point is further discussed in the nitrogen editorials and in the article reviewing the

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Production, Yields and Values of Byproduct Coke and Coke Byproducts

(Data from U. S. Bureau of Mines)

	1927		
	Yield per Ton of Coal Treated	Value F.O.B. Works, per Unit Sold	Value per Ton of Coke Made
Coke	1,388 lb.	$6.57 per ton	$5.29c
Screenings and breeze	130 lb.a	$2.85 per ton	0.20
Tar	8.6 gal.	5.3c. per gal.	0.66
Ammonium sulphate or equivalent	22.7 lb.	2.0c per lb.	0.62
Crude light oil	2.9 gal. a	11.6c per gal.	0.58
Light oil derivatives	2.3 gal. a	18.8c per gal.	
Gas, total	11.1 M cu.ft		
Gas, surplus	6.5 M cu.ft.	17.2c per M b	1.60
Total value of coke and byproducts			$8.93

a Average for plants actually recovering.

b The sale price for gas varied widely according to the purpose for which it was sold, as follows: Used under boilers 7.2 cents per M, used in steel and related plants 10.9 cent sper M, used for industrial purposes 17.6 cents per M, distributed for city use 33.9 cents per M.

c The sales price for coke varied according to the purpose for which it was sold, as follows: for furnace use $5.58 per short ton, for foundry use $7.80 per short ton, for other industrial use $6.83 per short ton, for household use $6.90 per short ton.

Data for 1926 and 1927 from U. S. Bureau of Mines except items marked with an asterisk (*); these marked items and estimates for 1928 by *Chemical & Metallurgical Engineering*

	1926	1927	1928
Coal processed (million net tons):			
Beehive coke ovens	19.2	11.2	7.1
Byproduct coke ovens	63.6	63.2	68.6
Coal-gas retorts	5.0*	5.1*	5.4
Total	87.8*	79.5*	81.1
Coke produced (million net tons):			
Beehive coke	12.5	7.2	4.4
Byproduct coke	44.4	43.9	48.0
Oven coke breeze	4.4	4.1	4.3
Retort coke	3.0*	3.2*	3.5
Total	64.3*	58.4*	60.2
Gas produced (billion cu.ft):			
Coke-oven gas	707	701	770
Other coal gas	48*	56*	60
Other manufactured gas	283*	273*	265
Natural gas (marketed)	1,313	1,445	1,500
Total	2,351*	2,475*	2,595
Tar produced in coke ovens (million gal.)	530	547	600
Crude light oil produced (million gal.)	164	164	170
Ammonia produced, total sulphate equivalent (thousand net tons)	691	717	780
Naphthalene produced (million lb.)	7.9	8.3	8.7

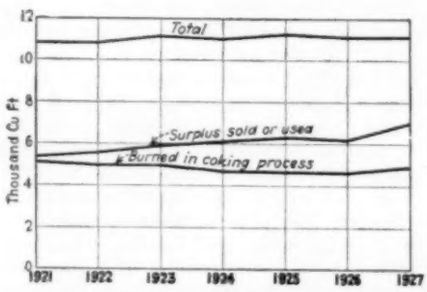
Byproducts Obtained from Coke-Oven Operations in 1927
Data from U. S. Bureau of Mines

Product	Unit	Production	Sales — Quantity	Sales — Value — Total	Sales — Value — Average
Tar	Gal.	546,859,205	305,898,176	$16,095,478	$0.053
Ammonia:					
Sulphate	Lb.	1,216,141,460	1,267,753,969	24,802,926	.020
Ammonia liquor (NH_3 content)	Lb.	54,694,723	53,994,327	2,580,342	.048
				27,383,268	
Sulphate equivalent of all forms	Lb.	1,434,920,352	1,483,731,277		
Gas:					
Used under boilers, etc.	M. cu.ft.	*700,894,799	25,848,762	1,866,342	.072
Used in steel or affiliated plants	M. cu.ft.		244,969,339	26,580,340	.109
Distributed through city mains	M. cu.ft.		106,910,108	36,249,081	.339
Sold for industrial use	M. cu.ft.		30,661,148	5,396,405	.176
			408,389,357	70,092,168	.172
Light oil and derivatives:					
Crude light oil	Gal.	†164,488,233	9,265,948	1,077,957	.116
Benzol, crude and refined	Gal.	22,007,760	21,193,807	4,371,519	.206
Motor benzol	Gal.	86,995,343	86,802,745	14,629,999	.169
Toluol, crude and refined	Gal.	12,093,590	11,784,984	3,999,820	.339
Solvent naphtha	Gal.	4,979,736	3,661,970	926,787	.253
Other light oil products	Gal.	3,155,031	1,393,876	147,017	.105
		‡129,231,460	134,103,330	24,153,099	.188
Naphthalene:					
Crude	Lb.	8,302,845	7,848,224	86,078	.011
Other products				93,791	
Value of all by-products sold				§ 138,903,882	

* Includes gas wasted and gas used for heating retorts.
† Refined on the premises to make the derived products shown 161,072,729 gallons.
‡ Total gallons of derived products. § Exclusive of the value of breeze production.

nitrogen products markets, elsewhere in this issue of *Chem. and Met.*)

6. Light-oil production and the refining of light oil to make various products has been stimulated by constantly increasing market demands. During the latter part of 1928 a sharp upturn occurred in the prices of toluol, benzol, and solvent naphtha which gives promise of still further activity in light-oil refining. (This point is further discussed in paragraphs which follow.)



Average Yield of Gas Per Ton of Coal Charged in Byproduct Ovens in U. S.
(Data from Bureau of Mines)

As a consequence of these and other important factors the results of the 1928 coal products business were more striking in both technologic and economic characteristics than for many years past. Some of the significant facts which are worthy of note, in addition to the tabular summaries of data which accompany this report, are the following:

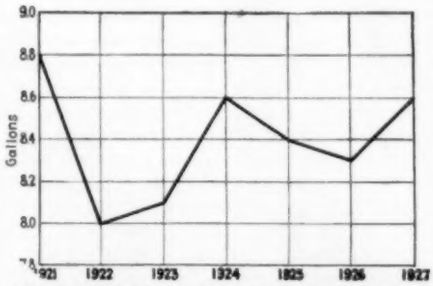
There were 78 byproduct oven plants operating at the beginning of the year, and 82 at the end of the year. These plants increased their operations from about 81 per cent of their maximum rated capacity up to 88 per cent of capacity near the close of 1928.

New plants built and put into operation during the year included 45 ovens at Hamilton, Ohio; 61 ovens at New Haven, Connecticut; 70 ovens at South Chicago, Illinois; and 41 ovens at West Duluth, Minnesota. All of these plants consisted of Becker ovens; the first three plants reported were new installations, but the plant at West Duluth replaced 65 old United-Otto ovens.

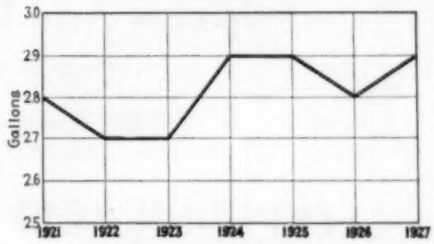
Increases of oven activity occurred mainly in Western New York, Pennsylvania, Ohio, Illinois, Indiana, Michigan, and Missouri. The other regions of the country produced substantially the same quantity of byproduct coke as during the previous year.

Approximately 79 per cent of the byproduct coke is now made at plants directly affiliated with metallurgical works; the balance is produced at "merchant" plants.

Stocks of byproduct coke at byproduct plants on October 1, 1928 were higher than at any time reported in the four preceding years and only about 15 per cent below the high stocks reported on September 1, 1924. Apparently, however, this large stock of coke does not involve any serious financial difficulty for the industry because of the constantly increasing rate of use of coke for household purposes. This development of household coke markets has been largely encouraged by greater attention to the making of a dense coke better suited to household furnace use.

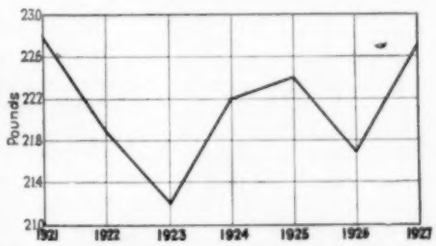


Average Yield of Tar Per Ton of Coal Charged in Byproduct Ovens in U. S.
(Data from Bureau of Mines)



Average Yield of Light Oil Per Ton of Coal Charged in Byproduct Ovens in U. S.
(Data from Bureau of Mines)

Numerous new coal-gas and coke-oven plants have been established for city-gas supply either replacing or supplementing water-gas works. Some of these plants which yield products substantially identical with the products from regular coke ovens have not been classified as "coke ovens," and hence as yet are not included in the totals of this summary which are based primarily upon the statistical records of the U. S. Bureau of Mines. However, such plants do not usually recover ammonia or light oil and almost never make coke except for local industrial or household use. Hence only the figures for domestic and industrial coke (non-metallurgical), city gas, and tar are low because of the omission of returns from these few plants. Furthermore, in the case of these products which are affected by the omission, the discrepancy for the country totals is probably in no case greater than two or possibly three per cent.



Average Yield of Ammonium Sulphate (or equivalent) Per Ton of Coal Charged in Byproducts Ovens in U. S.
(Data from Bureau of Mines)

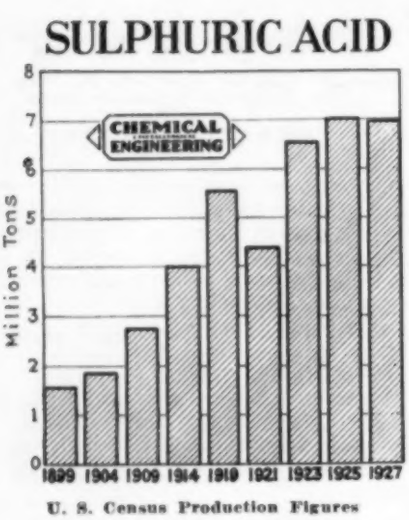
Dyes Gain Over 1926

The output of dyes in the United States produced by 55 firms was 8.2 per cent greater in 1927 than in 1926, representing a total of 95,167,905 pounds. Sales amounted to 98,339,204 pounds, valued at $38,532,795 as compared with 86,255,836 pounds valued at $36,312,648 in 1926. Increased production in indigo, sulphur black and vat dyes, other than indigo, was responsible for nearly all of the increased output. Increased sales were explained principally by the increase in sulphur black, indigo, other vat dyes, direct and acid dyes.

This production was put out by 17 less manufacturers than were in business in 1925 and 38 less than in 1919. The weighted average price per pound was 39 cents as compared with 42 cents in 1926 and $1.26 in 1917.

Sulphuric Acid Enjoyed Best Year Since the War

By Andrew M. Fairlie
Consulting Chemical Engineer, Atlanta, Georgia



U. S. Census Production Figures

DURING 1928 the sulphuric acid industry of the United States enjoyed its best year since the war. In all parts of the country acid plants were busy throughout the year, and in some sections plants were forced to produce in excess of their normal capacity, in an effort to keep pace with the demand. Prices, which have been forced higher within the past year or two on account of advances in the price of brimstone, were well maintained during the year.

New acid plant construction during 1928 included two new installations of Mills-Packard water-cooled chambers. Both installations were additions to existing box-chamber plants, to operate in conjunction with the latter to effect an increase in production capacity. One of these was a single chamber of the 11,890 cu.ft. size, erected by the Armour Fertilizer Works at their Houston, Texas plant. The addition of this one chamber has effected a reduction in the total chamber space required, per pound/day of sulphur burned (including Mills-Packard and box chambers combined) to about 6 cu.ft. This is the third installation of Mills-Packard chambers now in use by the Armour Fertilizer Works. The Armour plants at Jacksonville, Fla., and at Wilmington, N. C., consisting of Mills-Packard chambers exclusively, operate on about 3½ cu.ft. of chamber space per pound/day of sulphur.

The other Mills-Packard installation erected during 1928 consists of two groups of three chambers each, of the 18,750 cu.ft. size, erected as additions to the two box-chamber units of the American Zinc Lead and Smelting Company, at their East St. Louis plant. The expansion program included also a new Glover tower, larger gas flues, new fans, enlarged Gay Lussac towers, and two new Herreshof roasters. The first of the two acid systems to have its additions completed went into operation last November, and it has been already established that the addition of 56,000 cu.ft. of Mills-Packard space to a box-chamber unit consisting originally of 340,000 cu.ft. of space, together with the other improvements instituted at the plant, have increased the former production capacity by more than 60 per cent.

THE substitution of ammonia oxidation equipment for niter pots at chamber plants has proceeded steadily throughout 1928. By means of ammonia, acid manufacturers enjoy a reduction in costs ranging from 20 to 40c. per ton of 60 deg. Bé. acid, depending on the capacity of the plant. The cost of the ammonia equipment is usually paid for by the savings in from 12 to 15 months. The larger acid plants, almost universally, have installed anhydrous ammonia equipment, whereas at plants of small capacity, ammonia liquor has been adopted. As the recently-introduced use of anhydrous ammonia in the manufacture of mixed fertilizer expands, it seems likely that the small acid plants of the fertilizer companies, also, will be able to enjoy the advantages of anhydrous ammonia. Nearly all of the large acid producers of the country have now installed ammonia oxidation equipment. A number of the small acid plants are still using nitrate of soda.

In March, 1928, public announcement of the development, in the laboratories of the Monsanto Chemical Company of St. Louis, of successful types of vanadium catalysts for the oxidation of sulphur dioxide, was made by L. F. Nickell. These catalysts were developed chiefly during 1925 and 1926, and by the beginning of 1928, were in successful use at five different contact acid plants located in Missouri, Oklahoma, Pennsylvania and Wisconsin. The new vanadium mass is protected by various U. S. Patents. The conversion efficiency attainable is said to be regularly 97 to 98 per cent., when operating on brimstone gas. In addition to the great saving in first cost of vanadium mass, as compared with the cost of platinum mass, the new catalyst, it is claimed, is exempt from poisoning by such substances as arsenic and hydrochloric acid. In consequence, the gradual decrease in conversion efficiency experienced with platinum mass, is with vanadium mass avoided, and the original high efficiency is maintained, resulting in a continuous high yield of sulphuric acid. During 1928 a vanadium mass known as the Selden mass and manufactured by the Selden Company of Pittsburgh, was introduced, and several new contact units designed to operate with Selden mass were erected during 1928 in Maryland and New Jersey.

A new converter, designed for use with vanadium mass, for which special merit is claimed, has been patented by A. O. Jaeger.

About the middle of 1928 a new type of tower-packing was placed on the market by Maurice A. Knight, of Akron, Ohio. The new packer, which is called the "Hexahelix" packing block, is hexagonal, and has a twisted spiral vane inside, extending entirely to the center. Towers packed with this block have no straight-flow passages, but only winding or spiral passages, for the flow of gas and liquid. It is claimed that the liquid supplied to this new packer wets the spiral on both sides.

DURING the year the Chemical Construction Company introduced a new combination brimstone-burner and steam-generator. The steam generated is used to melt the brimstone supply in a small tank, and the molten sulphur is pumped by steam-jacketed pumps through steam-jacketed pipes to an injector which atomizes the molten sulphur within the burner, where the sulphur dioxide is generated. The same company has adopted the practice of pre-drying the air used for the combustion of the sulphur, by washing with concentrated sulphuric acid, and the dried air is blown into the sulphur burner under pressure. It is found possible by this means to eliminate some of the gas-purification apparatus usually employed beyond the sulphur burner, with a diminution in cost of power for moving gases through the plant.

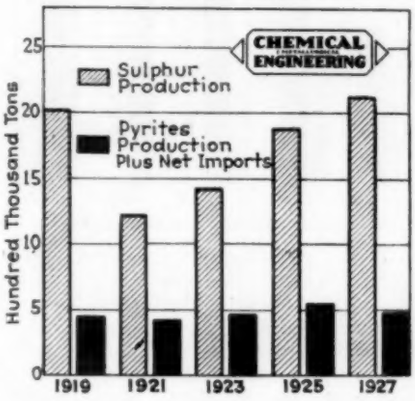
So far as improvements go, the nitration processes and the contact processes appear to keep pace with each other The reduction in plant investment effected for the nitration process by such inventions as the Mills-Packard chamber, the Gaillard turbo-disperser and the Schmiedel roller-box parallels that achieved for the contact process by vanadium catalysts and the reduced operating cost realized at contact plants by means of the decreased consumption of power and the improved acid yield is counterbalanced at the nitration plants by substituting motor-driven pumps for blow-cases, and ammonia oxidation equipment for niter pots. Manufacturers who operate both types of processes state that for the production of 66 deg. acid and stronger, the contact process is still to be preferred, but that for 60 deg. acid and weaker, there is a differential in cost of about 50c. per ton H_2SO_4, in favor of the nitration process.

The better position of the fertilizer industry helped to broaden the market for sulphuric acid during the year. The fertilizer trade continues to hold the premier position among consumers. Production of acid by fertilizer manufacturers was increased but not to a point where that industry was independent as it still purchases considerable quantities from acid makers.

Sulphur Shipments Smaller Than in Preceding Year

By Raymond F. Bacon
Chemical Engineer, New York

SULPHUR AND PYRITES



THE YEAR 1928 was not equal to 1927 in the sulphur industry. It is estimated that final figures for shipments will show a decrease of nearly 100,000 tons. Official figures for production will approximate total shipments and consequently stocks of sulphur above ground will remain essentially the same as they were a year ago. Prices were steady throughout the year, no variation in the contract price of $18 per long ton at the mine being reported.

In the domestic market, 1928 began somewhat slowly, due in part to the slow start of the fertilizer industry. This industry throughout the year has been marked by an uncertainty of manufacturing and sales program. However, other industries, particularly the acid industry, for chemicals, and for its many other miscellaneous uses has shown steady progression to the point that the Fall of the year has seen a definite increase in the consumption of sulphur. The domestic paper and pulp industry, like that of Canada, has been disturbed and has been operating at about 80 per cent of its capacity. Canada and the United States took in 1927 approximately 1,450,000 tons of sulphur, and the figures for 1928 were practically the same. In spite of an unsettled market for paper and pulp, Canada will show imports of between 150,000 and 160,000 tons, the same as 1927.

Exports to foreign countries other than Canada have declined nearly 100,000 tons. This decline has been caused in part by the consumption of stocks laid in during the preceding year. Industrially, as measured by the consumption of sulphur, foreign countries have been operating about as they did in 1927. Some labor troubles were experienced in the Scandinavian pulp districts but not sufficient in length of time nor of sufficient seriousness to have any material affect upon the total amount of sulphur used in the export field.

Sicily, the second large factor in the sulphur industry of the world, has produced and shipped approximately 250,000 tons, which is practically the same as their operations in 1927.

PYRITES competition was encountered by the sulphur industry in the United States as has always been the case. The activity in the acid industry, together with low imports during 1927, has resulted in larger imports during 1928. At the end of nine months, official figures of the Department of Commerce show 346,000 tons have been imported and this at the end of nine months is far in excess of the total reported for the whole of 1927, which was 250,000 tons. It is estimated that official figures for pyrites imports will show about 400,000 tons brought into this country during 1928 and if this is correct it will be the largest imports since 1919.

With the better market for copper it was to be expected that there would be an increase in pyrites imports as well as pyrites production. Virginia and California produce most of the pyrites mined in the United States, disregarding the production of pyrites in the copper mines. In 1927 our domestic mines produced 215,000 tons and, as stated above, when final reports are in it is expected that this production will show an increase.

Pyrites in the United States

	Production	Imports
1920	310,777	332,606
1921	157,118	216,229
1922	169,043	279,445
1923	181,628	263,695
1924	160,096	243,237
1925	170,081	276,385
1926	166,559	366,151
1927	215,786	250,794
1928 (est.)	250,000	400,000

Sulphur in the United States

	Production	Domestic Shipments	Exports	Total Shipments	Surplus Production
1920	1,255,249	1,040,175	477,450	1,517,625	—262,376
1921	1,879,150	668,672	285,762	954,434	+924,716
1922	1,830,942	857,960	485,664	1,343,624	+487,318
1923	2,035,847	1,146,316	472,525	1,618,841	+417,006
1924	1,220,600	1,055,586	481,814	1,537,400	—316,800
1925	1,409,262	1,228,602	629,401	1,858,003	—448,741
1926	1,890,057	1,495,721	576,966	2,072,687	—182,630
1927	2,111,618	1,282,738	789,371	2,072,109	+ 39,509
1928 (est.)	1,975,000	1,300,000	675,000	1,975,000	.....

At the time this was written, various economists are prophesying great industrial activities during 1929. If this should prove to be true, then it may be expected that the sulphur industry will move into higher levels for total production and sales, for in spite of some slowing up during 1928 the decrease from the former years of 1926 and 1927 was comparatively slight and those years may be taken as the forerunners of a greater market for sulphur.

Synthetic Acetic Acid on The Market

ONE OF the features in the market for acetic acid consisted in the commercial establishment of a synthetic product. For more than a year there have been rumors that synthetic acid would make its appearance and at last the rumor became an actuality. Contracts for glacial acetic acid are said to have been taken in fair volume and shipments from producing plants are expected to reach sizable quantities in the present year.

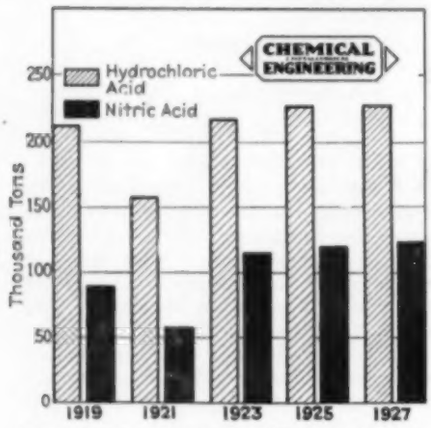
Wood distillers found a quiet period for their product in the early part of the year but the market soon livened up and active buying was reported in the latter part of the year. Production costs rose, principally because of scarcity and high prices for acetate of line and acid likewise was marked up accordingly.

Offerings for sale of acetic acid in 1927 amounted to 76,432,005 lb. valued at $5,523,752. In addition 19,501,700 lb. was made and consumed in the same establishments. The 1927 offerings were divided on a basis of 46,228,162 lb. dilute acid and 30,203,843 lb. glacial and anhydride. These figures compare with for-sale offerings of 65,591,553 lb. valued at $4,437,622 in 1925. In addition 1,342,361 lb. was made and consumed in same establishments. The 1925 offerings were divided, 28,722,303 lb. dilute, and 36,869,250 lb. glacial and anhydride.

Sulphuric Acid Production Increased

EXPANSION of manufacturing operations in the fertilizer trade was a prominent factor in increasing demand for sulphuric acid last. Refiners of petroleum also increased their requirements and the majority of consuming industries took deliveries of larger amounts than was the case in 1927. In order to take care of the larger buying movement, producers of acid enlarged their outputs and it is estimated that on a basis of 50 deg. Bé.,

HYDROCHLORIC AND NITRIC ACIDS



U. S. Census Bureau Production Figures

sulphuric acid production in 1928 exceeded that for 1927 by approximately 300,000 tons.

According to census figures, production of sulphuric acid in 1927, in 50 deg. Bé. equivalent, amounted to 6,922,201 tons of which 2,070,364 tons was consumed in producing establishments and 4,951,837 tons was offered for sale. Details for production in 1927 according to strength are not yet available, but of the quantities offered for sale in 1923 and 1925 the division by strength was as follows:

Sales of Sulphuric Acid, By Grades

1923–1925

	1923 Tons	1925 Tons
50 deg. Bé.	259,812	723,955
60 deg. Bé.	1,294,720	971,750
66 deg. Bé.	674,148	787,826
Oleum and other	961,355	967,525

Of total production in 1923, 72.4 per cent was made by the chamber process and 27.6 per cent by the contact process. In 1925, 70.8 per cent of production was credited to the chamber process and 29.2 per cent to the contact process.

One of the features of production in 1928 was the increase in the use of pyrites as a basic raw material. Consumption of sulphur by acid makers was about the same as in the preceding year. The increase in output of acid, therefore, represents the expansion in use of pyrites.

With consumption keeping pace with production and with raw materials maintaining a strong position, prices for all grades of sulphuric were firm throughout the year.

New Producers in Chromic Acid Trade

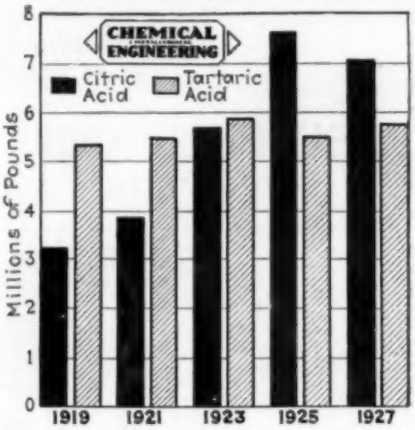
UP TO the last few years chromic acid was produced only in a limited way and the small consumption rendered the acid of slight commercial importance. The development of a chromium-plating process in which chromic acid plays an important part has brought the acid into prominence. In 1927, domestic production, as represented by the amount offered for sale, was 898,093 lb. valued at $241,965. In 1928, new producers entered the field and substantial increases in production were reported over the preceding year.

Tartaric Acid Production Costs Advance

HIGHER prices for raw materials during the latter part of the year had a strengthening effect upon quotations and closing prices were higher than those which were in effect earlier in the period. In fact the market in the first half of the year was under selling pressure at times and keen competition among sellers brought actual sales prices below the openly quoted figures. Imports of acid were of a declining tendency and in the first eleven months of the year, arrivals from abroad amounted to 1,803,816 lb. in comparison with 2,587,139 lb. for the corresponding period of 1927.

ACCORDING to foreign estimates the world's production of tartaric acid is estimated at about 20,000 tons. Of this quantity 9,500 tons is contributed by the German-Italian Syndicate, 5,000 tons of this being made in Italy. France produces 2,000 tons, England 2,500 tons,

CITRIC AND TARTARIC ACID



U. S. Census Bureau Production Figures

America 3,500 tons, Austria 500 tons, Spain 500 tons, Australia 500 tons, and Poland, the Balkan countries and Russia, together 1,000 tons. It is estimated that the production capacity of the German-Italian Syndicate is 12,000 tons a year.

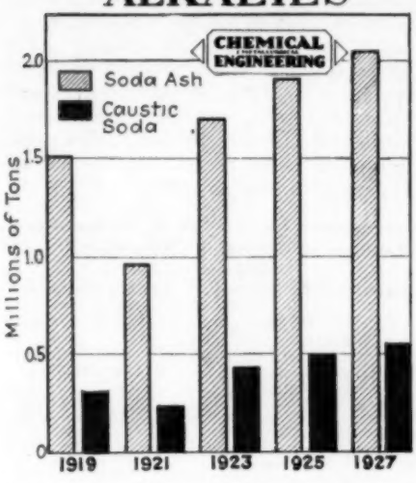
Domestic production of tartaric acid is reported to have gained in volume in the last year but no official figures are available. In 1927, according to census reports, the home output of tartaric acid which was offered for sale, amounted to 5,781,166 lb. This compares with 5,498,920 lb. for 1925.

Domestic Production of Acids 1925–1927

	Year	Number Establishments	Unit of Weight	For Sale — Quantity	For Sale — Value	Made and consumed in same establishment — Quantity
Aggregate value	1927	.....	.....	.....	$87,129,151	.....
	1925	.....	.....	.....	80,151,249	.....
Acetic	1927	17	Lb.	76,432,005	$5,523,752	19,501,700
Dilute	1927	.....	Lb.	46,228,162	2,327,085	10,762,097
Glacial and anhydride	1927	.....	Lb.	30,203,843	3,196,667	8,739,603
Acetic	1925	16	Lb.	65,591,553	4,437,622	1,342,361
Dilute	1925	.....	Lb.	28,722,303	775,668	1,102,650
Glacial and anhydride	1925	.....	Lb.	36,869,250	3,661,954	239,711
Boric (boracic)	1927	6	Lb.	21,009,603	1,582,565	.....
	1925	4	Lb.	15,604,654	1,202,382	.....
Carbonic (carbon dioxide)	1927	48	Lb.	70,466,801	6,001,424	.....
	1925	44	Lb.	59,721,309	5,128,441	.....
Chromic[1]	1927	6	Lb.	898,093	241,965	.....
Citric	1927	4	Lb.	7,058,215	3,150,976	.....
	1925	6	Lb.	7,598,213	3,469,740	.....
Hydrochloric (muriatic)	1927	37	Ton	158,674	2,954,299	62,154
20° Baumé	1927	.....	Ton	132,607	2,491,613	59,170
18° Baumé	1927	.....	Ton	22,987	224,263	1,635
Other	1927	.....	Ton	3,080	238,423	1,349
Hydrochloric (muriatic)	1925	37	Ton	155,019	2,976,155	72,781
20° Baumé	1925	.....	Ton	130,865	2,483,183	70,228
18° Baumé	1925	.....	Ton	22,908	322,299	2,553
Other	1925	.....	Ton	1,246	170,673	.....
Hydrocyanic	1927	6	Lb.	2,283,395	1,078,770	.....
	1925	7	Lb.	2,288,598	888,101	.....
Hydrofluoric	1927	5	Lb.	6,675,288	614,125	.....
	1925	8	Lb.	5,688,303	526,555	.....
Mixed (sulphuric-nitric)	1927	40	Ton	60,625	3,820,564	114,804
	1925	39	Ton	61,290	3,766,701	99,439
Nitric[2]	1927	50	Ton	28,722	3,559,436	95,127
	1925	53	Ton	26,852	3,559,695	92,800
Oleic (red oil)	1927	14	Lb.	74,449,927	5,531,641	.....
	1925	15	Lb.	65,036,276	6,957,871	.....
Phosphoric	1927	8	Lb.	22,397,366	1,681,504	50,955,573
	1925	7	Lb.	21,330,215	1,488,701	33,241,707
Stearic	1927	10	Lb.	29,502,808	3,047,175	.....
	1925	9	Lb.	19,761,268	2,469,852	.....
Sulphuric (50° Baumé)	1927	185	Ton	4,851,837	41,966,021	2,070,364
	1925	177	Ton	4,700,197	38,230,284	2,303,915
Sulphuric reclaimed	1927	63	Ton	193,029	1,088,554	540,769
	1925	66	Ton	209,589	1,479,145	559,176
Tannic	1927	3	Lb.	1,297,232	593,465	.....
	1925	6	Lb.	1,439,957	585,951	.....
Tartaric	1927	4	Lb.	5,781,166	1,810,898	.....
	1925	4	Lb.	5,498,920	1,541,955	.....
Other acids	1927	.....	.....	.....	[3] 2,882,017	.....
	1925	.....	.....	.....	[1] 1,442,098	.....

[1] Chromic acid included in "Other acids" for 1925.
[2] Total production, basis 100 per cent: 1927, 92,210 tons; 1925, 80,443 tons.
[3] Principal acids named in order of value: vanadic, oxalic, lactic, pyrogallic, molybdic, propionic, hydriotic, and gallic.

ALKALIES



U. S. Census Bureau Production Figures

Heavy Contract Buying in Alkalies

WITH a distribution into the majority of basic industries, alkalies necessarily are affected by the status of general business. Hence the prosperous conditions reported in general manufacturing lines in 1928 furnishes a fairly accurate guide in estimating activities in the alkali trade. Actual figures on production of alkalies in 1928 are not yet available but, based on trade opinions and on the position of consuming industries, the output for the year averaged slightly more than 5 per cent higher than the totals reported for 1927.

From a production standpoint, one of the important developments of the year was found in the enlargement of productive operations on the Pacific coast. Moreover, plans have been made for still greater production in that section during the coming year. This development is attributed not only to the economic principle of equalizing sectional production and consumption but also to the fact that western plants occupy a strategic position with reference to export demand from the Far East.

Export buying of alkalies was more active during the year but competition for world trade is very keen and recent years have brought considerable changes in our export trade. At present South American countries offer the largest outlets for domestic producers.

IN THE last quarter of the year, contract prices for 1929 deliveries were made public. Contract commitments were unusually heavy and some producers have arranged to manufacture on a larger scale in 1929 in order to take care of the orders placed with them. With consuming industries in a favorable position and a very large part of output sold ahead the outlook for the industry in the coming year is encouraging with every indication of an expansion in output.

As a large part of alkali production is sold on a contract basis, price fluctuations throughout the year are minimized. Seldom are changes made in the openly quoted price schedules but, at times, competition reaches a point where buyers are able to obtain price concessions. A strong price tone is expected to develop during the coming year. This is based not only on the increase in contract sales but also on the fact that producers employing the electrolytic process will receive smaller returns this year on sales of chlorine and this, in turn, will reflect directly on production costs for alkalies. It is not improbable, that, as the year advances, spot supplies of caustic soda will command a premium.

Bichromate of Soda Finds Larger Market

COMPETITION among sellers of bichromate of soda was less keen last year than in preceding years and a higher price level was maintained throughout the period. The stronger position of sulphuric acid had some effect on production costs for bichromate but other raw materials were unchanged. Sellers have been accustomed to grant relatively low prices to a few buyers who contract for very large quantities but on smaller business the quoted prices are generally upheld.

Color makers have been steadily increasing demand for bichromate of soda and buyers in the tanning and textile trades took on normal amounts last year. The census figures for 1927 report a production of 31,462 tons of bichromate and chromate of soda valued at $3,780,435. This compares with an output of 26,879 tons in 1925 and 18,169 tons in 1923.

Export trade in bichromate and chromate of soda ran slightly below that for the preceding year.

Soda Ash Market Steadily Expanding

REVIEWING the market for soda ash, it is apparent that there has been a natural increment in production in recent years. Large consuming trades have been operating on an increasing scale and have taken on raw materials accordingly. It is estimated that soda ash offered for sale last year amounted to 1,484,000 tons. According to census figures, soda ash offered for sale in 1927 reached a total of 1,466,878 tons valued at $29,947,396. Of this total 1,402,728 tons was produced by the ammonia-soda process and 64,150 tons consisted of natural ash and ash made by the electrolytic method.

The market for soda ash has been free from unusual conditions during the year with a large part of production sold ahead at all times and a routine delivery taking stocks from producing points. There were no important changes in the field of distribution and glass makers continued to be the chief consumers, absorbing more than 40 per cent of the ash offered for sale.

Larger Production of Borax Last Year

By Paul D. V. Manning

Assistant Editor, Chem. & Met. San Francisco, Calif.

DURING THE past several years, the price of borax has been steadily declining. In 1927 it reached a new low figure of $40 to $50 per ton on contract sales and this price included delivery. This is just half the old delivered price and some sales were undoubtedly made at figures lower than these. When considered over the period of years within which this price trend obtains, it is perhaps remarkable that new uses for this substance have not been developed. This is explained, however, by the fear on the part of those interested that these low prices might be the result of a price war which would be short-lived.

With the American Potash & Chemical Company producing at plant capacity and the Pacific Coast Borax Company working their deposits at Kramer, this fear on the part of the consumer is apparently groundless and borax can now advantageously enter into competition with soda ash in certain fields.

Further strengthening of the situation from the user's standpoint is drawn from the fact that the number of producers increased during the past year. The principal producers with estimated production during 1928 were:

Producer	Approximate Production in Tons per Month
In the Kramer district:	
Pacific Coast Borax Company	6,000
Western Borax Company (began production in November)	2,000
At Searles Lake:	
American Potash and Chemical Co.	4,000
Westend Chemical Company	400

In addition, there are several small producers in the Kramer and Searles Lake districts.

PRODUCTION of borate ores showed a further decline during the year with indications that this will continue unless new uses are found for ulexite and colemanite. A possibility here is the ceramic industry but the problems presented by non-uniformity of raw material have yet to be overcome. It is in the glass and textile industries that there is eminent opportunity for borax to replace other alkalies.

In spite of the low prices, the producing end of the industry is evidently in a healthy state and there is little doubt that production will increase in 1929.

The refining center is moving West, it being reported that the Pacific Coast Borax Company is to cease its operations at Bayonne and carry all of this work in California.

Exports increased during the year, the total for the first nine months being 57,756 tons which more than doubled the exports in the same period of 1927. The world's consumption of borax increased slightly in 1928.

Higher Import Duty Advocated for Sodium Phosphate

By Robert Weatherly

Sales Manager, The Federal Phosphorus Co.

MANY INTERESTING developments have taken place in phosphoric acid and phosphate salts during the past year. Increased production in the automobile industry has stimulated demand for phosphoric acid for metal cleaning and rust proofing. The past year saw the entrance in the market of a new producer, which has increased competition to a certain extent. While there has been some increased activity in phosphoric acid, the productive capacity is sufficient to handle the demand of the consuming trade. It is also reported that additional capacity may come into production during 1929. On the whole, prices for phosphoric acid have been firm during the past year and during the contract period which has just closed.

One of the most encouraging developments in the market for sodium phosphate is the recent preliminary statement issued by the United States Tariff Commission, which shows that a 50 per cent increase in the present duty is justified by the difference in the cost of production in the United States and in the principal competing countries, Germany and Belgium. A public hearing has been set by the Tariff Commission for January 15 prior to submission of its report to the President.

THE competition from imported sodium phosphate has been particularly disturbing in the Eastern market for disodium phosphate. With an increased duty effective, there should be a tendency for prices on disodium phosphate to become more stable. The extent of this foreign competition is shown by the following tabulation of imports of sodium phosphate for the past few years. About 80 per cent of the total import has been disodium phosphate.

Imports of Sodium Phosphate Into The United States

Year	Lb.	Value	Value per Lb.
1923	1,661,562	$46,055	$0.0276
1924	1,818,222	45,028	0.0248
1925	4,500,220	101,908	0.0227
1926	9,055,458	227,932	0.0252
1927	16,770,555	395,402	0.0236
1928 (9 months)	13,174,330	296,340	0.0225

During 1928 a new form of trisodium phosphate appeared on the market. This product consists of round, spherical crystals which are produced by spraying molten trisodium phosphate into a congealing atmosphere. This process eliminates many of the steps in the previous standard method of crystallizing, centrifuging and drying. At the same time it produces a product which is exceptionally free-flowing and does not cake in the packages.

There has been an increased demand for phosphoric acid and for the various phosphate salts for the treatment of boiler water, especially in plants operating at high pressures. With the increasing use of high pressures in boiler plants throughout the country, a considerable outlet should develop for phosphate salts. Phosphoric acid is used in conjunction with sulphuric acid to neutralize the alkalinity in the boiler water after softening. This prevents the generation of carbon dioxide in the boilers which tends to corrode the tubes. Trisodium phosphate is also used in connection with lime-soda softening plants to precipitate the last traces of lime, instead of using an excess of soda ash which produces a high caustic alkalinity resulting in caustic imbrittlement.

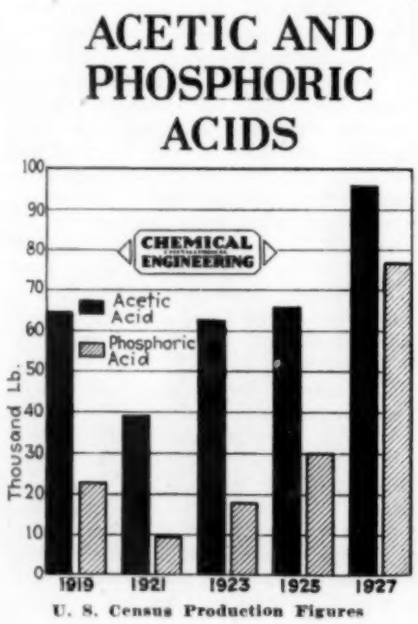
THE consumption of sodium phosphate continues to increase gradually, as shown by recent figures published by the Tariff Commission. The production of all forms of sodium phosphate in 1926 was about 165,000,000 lb., which is an increase of about 6,000,000 lb. over the previous year. With two new companies entering the field in 1928, the productive capacity in the United States is far above the actual consumption.

The statement of the Tariff Commission referred to above makes available for the first time detailed and accurate information on the geographical consumption of sodium phosphate. This shows, as has been recognized, that about 85 per cent of the total consumption of disodium phosphate is used by the silk mills of Paterson, N. J., and vicinity. In contrast, the wholesale markets for trisodium phosphate are much more widely distributed. The accompanying table shows the geographical distribution to the wholesale consumers, who are represented to a considerable extent by companies packaging trisodium for household and industrial cleaning purposes.

Geographical Distribution of Wholesale Consumption of Trisodium Phosphate in the United States, 1926
(Data from Report of U. S. Tariff Commission

	Lb.	Per Cent of Total
1. New England (Me., N. H., Vt., Mass., R. I., Conn.)	3,411,000	3.1
2. Middle Atlantic (N. Y., N. J., Pa., Del., Md., D. C., Va., W. Va.)	34,283,088	31.2
3. East North Central (Ohio, Ind., Ill., Mich.)	37,475,365	34.1
4. West North Central (Mo., Iowa, Nebr., N. D., S. D., Minn., Kans., Wis.)	11,336,824	10.3
5. South Atlantic and East South Central (N. C., S. C., Ga., Fla., Ala., Miss., La., Ky., Tenn.)	10,712,654	9.8
6. West South Central (a) (Ark., Texas, Okl.)	464,890	.4
7. Rocky Mountain (Mont., Col., Utah., Ariz., Nev., N. M., Idaho, Wyo.)	8,829,578	8.0
8. Pacific (Wash., Oregon, Calif.)	3,349,751	3.0
Total	109,863,489	99.9

(a) Louisiana belongs in this Group but figures were combined with other States in 5.



U. S. Census Production Figures

Sodium Silicofluoride in Tariff Controversy

DEVELOPMENTS in the market for codium silicofluoride have centered in the possibility of changes in the status of the industry as a result of changes in the import duty. Under the Tariff act of 1922, this material is dutiable at the rate of 25 per cent ad valorem. Upon application of two domestic producers the Tariff commission on July 24, 1925, began an investigation of foreign and domestic production costs. While the investigation has been completed for some time, the question of duty has not been settled and a public hearing set for last December was postponed and will be held on January 15.

The investigation brought out that the chief user for sodium silicofluoride were as an ingredient in acid rinser in laundries, as an ingredient in the manufacture of iron enamel-ware, and in the production of opalescent glass.

Data on domestic production report an output of 1,384 tons for 1925 compared with production of 2,481 tons for 1923. Of this amount, 40 per cent represented consumption in the laundry trade. In 1923 domestic production was placed at 4,962,000 lb. valued at $302,758. In 1925 production had dropped to 2,768,000 lb. valued at $138,025. Present productive capacity of the country is estimated at 6,000,000 lb. per year. Imports in 1924 are reported at 1,943,794 lb., in 1925 at 2,458,974 lb., and in 1926 at 2.654.048 lb. Denmark and Holland are the principal countries offering competition in domestic markets.

Silicate of Soda Gained in Export Trade

INCREASED buying from outside the country was principal feature in the market for silicate of soda during the last year. In the first ten months of the period outward shipments were valued at 26 per cent more than the total reported for the corresponding period of 1927. The gain in quantity was less than that in valuation as the unit price was higher than in the preceding year. It is estimated that total exports for 1928 will exceed those for 1927 by almost 50 per cent in value.

According to the compilations of the Department of Commerce more than 90 per cent of exports of sodium silicate goes to Canada, Mexico, Cuba and Japan. Although Europe is not a large purchaser of American sodium silicate. Germany and Belgium have made substantial purchases this year, compared with none in 1927; France has taken over seven times as much as in 1927, and the United Kingdom 54 per cent more. In the North American group the gain is chiefly due to the outstanding purchases of Canada, offsetting small losses such as Panama's and Dominican Republic's which are less than half of 1927 purchases. In South America the gains are due chiefly to large increases in Brazil, Venezuela and Argentina. Bolivia, Chile and Colombia show substantial losses. In the Far East the gain is due to larger purchases by the main consumers namely Japan, nearly 50 per cent, Philippines 31 per cent, and China 14 per cent.

DOMESTIC production of silicate of soda has been steadily increasing. In previous years there have been reports that the output was larger than consumptive capacity and surplus stocks hanging over the market, at times, had a depressing effect on values. In the last year there was a closer harmony between supply and demand and a firmer price tone ruled in the market.

On a basis of 40 deg., domestic production of silicate of soda in the last five census years offers the following comparisons:

Production of Silicate of Soda

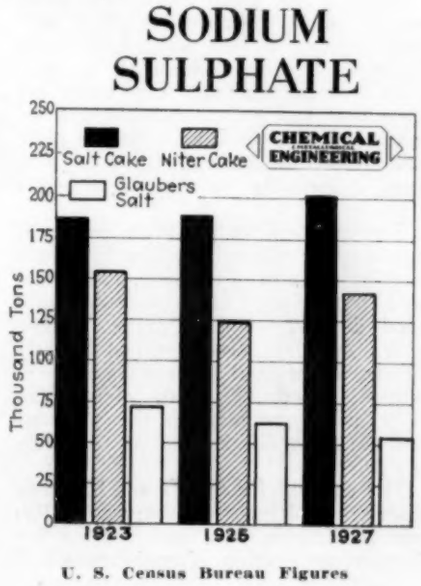
	No. of Establishments	Tons	Value
1927.....	23	499,857	$6,745,405
1925.....	23	394,884	5,717,426
1923.....	21	331,309	5,066,719
1921.....	21	221,550	4,641,754
1919.....	21	286,791	6,052,318

Caustic Soda Gains in Export Trade

ONE of the encouraging features in the market for caustic soda last year was the fact that export buying was about 20 per cent larger than in 1927. With competition very keen in foreign markets and with freight rates working against the domestic product as far as shipments to many outside markets are concerned, the gain in outward shipments was encouraging. According to the figures of the Department of Commerce, the gain in total exports of caustic soda has been due to the increases in sales in the Far East, South American, and African countries, and has been accomplished despite a loss of some of the business from the North and Central American and West Indies countries and most of the European business. The increase in the Far East is attributable largely to Japanese purchases which show an estimated increase of over 62 per cent, together with those of China which have doubled, the Philippines with a gain of 15 per cent, while Java and Madura have taken about 10 per cent more.

OF PARTICULAR note in the South African group is Mozambique's purchases, which show over 50 per cent greater than 1927. South American consumption of caustic soda from the United States shows a 15 per cent gain, of which the greater part goes to Argentina, Brazil, Colombia, and Peru. The estimated loss of 15 per cent in sales to the group of North and Central American and West Indies countries is attributable to slight estimated losses among the principal consumers, namely, Canada, Mexico, and Cuba. The estimated loss of 92 per cent to Europe is due to the loss of business on caustic soda to Italy for 1928 as compared with 1927 when sales amounted to $53,330. Thus, the effect of Italy's newly organized caustic soda industry is reflected in our export trade to that country.

Domestic consumption of caustic soda also showed expansion last year with practically all consuming industries increasing their allotments. It is estimated that total sales for the year were 595,000 tons or a gain of more than 7 per cent. Census returns for 1927 place the total of caustic soda offered for sale in that year at 557,861 tons valued at $28,987,375. Of this total 397,943 tons was produced by the lime-soda process and 159,918 tons by the electrolytic process. Compared with 1925 this represents a gain of 42,160 tons for the lime-soda process and 18,440 tons for the electrolytic process.



U. S. Census Bureau Figures

Exports of Borax Reach Record Figures

TWO features stood out in the borax market last year. First came the record-breaking shipment to outside countries. Exports of borax amounting to $3,227,000 for the first 10 months of 1928 are 33 per cent greater than for the entire year 1927. Estimates on the full year 1928 indicate nearly a 60 per cent increase over 1927. Europe and the Far East are the largest consumers of American Borax, the North, Central American and West Indies section ranks third, with South American fourth. The largest increases in the purchases of American borax by individual countries estimated for the entire year 1928, are in France 220 per cent, Germany 120 per cent, Italy 142 per cent, Netherlands 30 per cent. United Kingdom 33 per cent, China 1,500 per cent, Hongkong 500 per cent, the Philippines 54 per cent, and Japan 4 per cent. Those of the principal consumers whose purchases are less for the 10 months of 1928 than for the entire year 1927 are Canada, Brazil, and Colombia. However, the estimated total for this group for the entire year 1928 is about equal to 1927 sales.

The second feature was found in the low prices at which borax was offered. This was occasioned partly by competition among sellers but mainly because production was proceeding along lines where costs were much lower than had been the case in preceding years.

Production of borax also has been gaining in volume. In 1927 the domestic output was reported at 64,864 tons valued at $5,072,278 which compares with 49,967 tons valued at $4,083,209 in 1925 and 53,092 tons valued at $5,102,148 in 1923.

Sulphate of Soda Finds Slower Market

SOME of the consuming industries which formerly took large amounts of salt cake curtailed requirements during the year and stocks for a long period were pressing heavily on the market with the result that prices were lower than had been the case in a number of years. Later production was limited and a partial price recovery followed but values were below normal at the close of the year. Niter cake also was dull and showed an easy price tone but future production, owing to changes in manufacture of nitric acid, may fall below the standards of recent years and prices may move according to the volume of consuming inquiry.

Figures for production of salt cake for 1927 have just been announced by the Census Bureau and the total for that year is given at 169,063 tons valued at $2,697,960. Production of niter cake in the same period was 108,903 tons valued at $418,617. The output of glauber's salt was 54,420 tons valued at $1,081,960 and of refined anhydrous sodium sulphate 2,688 tons valued at $119,111

Production of Coal-Tar Chemicals Gained Slowly in Recent Years

By S. R. Church
Consulting Chemist, New York

THE COAL-TAR industry in the United States is becoming increasingly competitive, owing to the growth of the companies which have been in the field for many years, and the entrance into the field of a few new distillers, including as a very important factor the United States Steel Corporation at Clairton.

Production of coal tar has increased slowly during the past few years and 1928 will probably exceed 1927 production of 600,000,000 gal. by a small amount.

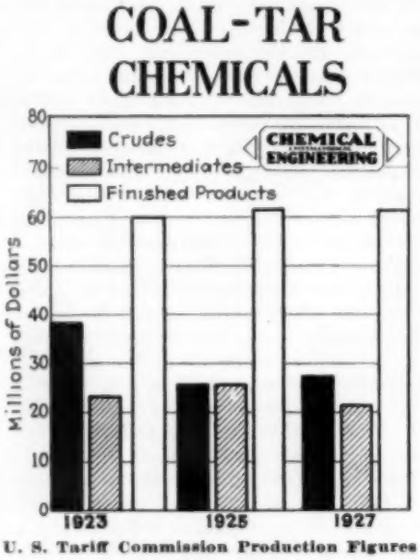
The amount of tar distilled, however, has undoubtedly increased considerably in 1928 over the amount of 245,000,000 gal. reported by the United States Tariff Commission (Census of Coal-Tar, Dyes and Crudes) for 1927. It is believed that the actual quantity distilled in 1927 was some 15,000,000 gal. greater than the quantity reported. According to present indications the year 1929 will see another increase in the use of tar by the distillers.

Of the principal tar products creosote oil enjoyed a substantial increase in use in 1927, reaching a total of 220,000,000 gal., or 35,000,000 gal. more than in 1926. It is unlikely that the 1928 figures will show the same proportionate increase, although another new high record for consumption of creosote is fully expected, and the wood preserving companies are looking forward to 1929 with confidence that records will again be broken.

In spite of strong demand, the production of domestic creosote during 1928 appears to have increased disproportionately to consumption with the result that prices have shown a slight tendency to decline. Import figures for the first nine months indicate a slight decline in total imports of creosote for 1928 over 1927.

REPORTS from Europe are conflicting. From Germany we hear that on account of the poor demand for briquet pitch increased efforts have been made to dispose of road tar which might indicate a tendency toward reduction in creosote production. In England, although the use of road tar in 1927 increased more rapidly than the production of tar and reached the remarkable figure of 175,000,000 gal., it is now reported that in some quarters increased competition with petroleum products has been experienced in 1928, and that in spite of the strong efforts that are being made to continue to expand the road tar business, the English tar distillers expect to continue pitch and creosote production at about the present rates.

In the United States the road tar business continues to hold its own against a generally lower level of prices on competing grades of petroleum products. This continuance of the sale of a fairly large volume of tar for road building and maintenance, in the face of lower priced competition with asphaltic materials, indicates that the road tars do occupy a necessary place in the national and state highway programs. One feature of the road tar business in which improvement is noted is the tendency toward greater uniformity in the state highway specifications with the result that the manufacturers do not have to make so many special grades, with resulting economies in storage and distribution. For these good results the credit no doubt largely lies with such bodies as the American Society for Testing Materials and the Association of State Highway Engineers.



U. S. Tariff Commission Production Figures

There is not much to be said about coal tar pitch. The surplus which normally occurs in this product is being converted to pitch coke with in most cases only fair returns. One outlet for pitch that has shown considerable increase of late is the development of pitch base protective coatings for steel pipe lines, principally in the oil and gas fields.

The business in tar acids has continued good. Cresylic prices have held firm during most of the year, and in fact have registered a slight increase with good demand. Phenol prices, despite active demand, have declined slightly due we understand to improvements in synthetic production with lower costs. Naphthalene remains in the previous position of good demand at relatively low prices.

The demand for anthracene has been practically nil for some years past. Recent publication of a new process for cheaper purification of anthracene and conversion to anthraquinone indicates the possibility of renewed interest in this crude, but for the present phthalic anhydride remains the source of production of anthraquinone, etc.

BENZOL for motor fuel has been in good demand throughout the year with prices firm excepting for a time during the first quarter. Benzol for export has also been going strongly since May 1, exports from May to September averaging above the yearly total of 26,000,000 gal. recorded in 1927. In the solvents group the demand in the lacquer field for toluol and xylol has resulted in high prices and occasional shortages, although one authority estimates that the toluol production for the year reached a new high total of possibly 12,000,000 to 14,000,000 gal.

A general survey of the business in coal tar crudes seems to indicate that excepting the benzol group which from a commercial standpoint is principally outside the tar distillers' field, the possibility of over-production is sufficiently real to merit consideration of those companies who are already engaged in tar distillation as well as others who are contemplating it. In spite of a gratifying increase in the use of coal tar products it is obvious that the total tar make of the country still far exceeds the present possible demand for tar products, and it may be that we have reached a point where a careful study should be made of the market's ability to absorb new products, before making further important installations of plant for distilling.

High Prices Obtained in Sales of Toluene

LIMITED supplies of certain solvents diverted consulning inquiries more actively to toluene during the year. Under the larger buying movement production became well sold ahead and the spot market in the latter part of the year was in a more or less nominal position with buyers bidding high prices for the small lots available. The recovery of toluene from light oils was stimulated by the position of the market but to sustain production on a large scale would bring the possibility of an oversupply of benzene, solvent naphtha, and xylene which would have a depressing effect on values. It is stated that production of toluene can be increased by the adoption of new processes at coke ovens whereby the yield of toluene from each ton of coal processed.

Production of toluene at byproduct coke plants will be found in the accompanying table. The totals do not include small amounts produced at gas works and from tar refineries.

Production of Toluene 1923-1927

	Gal.	Value
1927	12,000,000	$4,034,000
1926	8,650,605	2,914,752
1925	5,038,147	1,310,786
1924	3,231,502	769,682
1923	2,634,783	766,030

Larger Potash Supplies Last Year

By C. H. MacDowell
President, Armour Fertilizer Works

COMBINED IMPORTS and domestic production of potash during 1928 aggregated 80,000 tons in excess of those during any previous year. Consumption in the United States was only slightly above pre-war figures, although the world is using 44 per cent more than in 1913. Total world consumption in 1927 was more than 1,600,000 tons (K_2O), the greatest increases being in France, Holland, Great Britain, and Germany. Holland used one third as much as the United States, and Germany consumed nearly half the world production.

Prices remained stationary during 1928, the average of all grades being 98 per cent of the pre-war average prices; muriate averaged 94 per cent, sulphate 100 per cent, sulphate-magnesia 109 per cent, and kainit 107 per cent of 1913 prices. Domestic production amounted to more than 50,000 tons of potash, or one-sixth of the total United States consumption. The increased output was due to larger operations in California, particularly at the Searles Lake plant where potash is being made into a concentrated muriate that meets fertilizer manufacturers' growing demand for more concentrated mixed fertilizers. Importation of low-grade salts has steadily decreased, a result not only of the higher unit cost, but primarily owing to the need of more concentrated raw material. In 1913 large quantities of 12 per cent kainit were imported, but the amount consumed here now is almost negligible. Production of potash in the sulphate form has not kept pace with the muriate demand; its use is confined largely to the citrus and trucking sections of California and Florida. German and French producers have enlarged their propaganda force in this country, and are now employing about 50 field men.

WORLD production of potash is steadily increasing, and the United States is apparently a fertile field for absorption of surplus output. Efforts are still being made to develop the Texas and New Mexico potash deposits. Enlargement of Searles Lake production is dependent on the ability to market the increased borax output, so that the prospect of complete independence of foreign importation is not encouraging. Besides Germany and France, Poland is endeavoring to increase production. Last year Poland produced over 50,000 tons of potash, and, according to reports, an effort is being made there to finance larger developments in the near future. Reports are meager from Spain, where high costs have retarded increases in production. Russia is producing carbonate of potash at the rate of 3,000 tons a year from dried sunflower seeds, but has not as yet developed the natural potash deposits of the country.

Census Data for Chemicals and Allied Products

	No. of Establishments	Wage Earners	Cost of Materials	Value of Products
1914	13,229	349,154	$1,485,074,000	$2,685,423,000
1919	12,405	460,641	3,903,873,000	6,090,949,000
1921	8,894	314,231	3,111,425,000	4,594,777,000
1923	8,832	384,493	3,680,407,000	5,706,866,000
1925	8,871	381,075	4,184,911,000	6,438,027,000

Duty on Permanganate of Potash Increased

Among the chemical which were affected by tariff changes during the year was permanganate of potash. An application requesting an investigation in production costs here and abroad was made on November 12, 1926. The investigation was instituted on May 25, 1927, and on November 16, 1928 the President issued a proclamation authorizing an increase of 50 per cent in the duty on this chemical. Under the Tariff act of 1922 the duty on permanganate of potash was placed at 4c. per lb., hence the present duty is on a basis of 6c. per lb.

Prior to the war, there was no domestic production of permanganate of potash and imports in 1913 were 357,366 lb. which may be taken as representing our pre-war annual consumption. During the war, different companies produced this chemical in this country, but in recent years only one company has operated. Figures for domestic production are not available, but imports in 1927 amounted to 319,332 lb. Domestic production was reported to be considerably in excess of imports and it is evident that there has been a large increase in domestic consuming requirements over the pre-war standards.

DISTRIBUTION of permanganate of potash according to industries is given on the following basis:

	Per Cent
Lithopone	38
Poultry remedies	15
Medicinal	13
Fumigation	6
Sponge bleaching	6
Textiles	5
Miscellaneous	17

In the tariff investigation distribution of potassium permanganate imported during 1926 was obtained for 202,911 lb., or 86 per cent of the total imports. This quantity includes 169,911 lb., or 89 per cent of the imports through the port of New York, and 30,000 lb. through other ports.

The distribution of the imported material can not be published without revealing confidential information, but it may be said that the New York City area consumes the largest quantity of the imported material, 136,231 lb. being sold there, or 57.7 per cent of total imports during 1926. The three next largest consuming centers took from 11,000 to 26,000 lb. each.

Under competitive influences, prices for permanganate of potash were held on a very steady basis until the latter part of the year when an advance equal to one-half the increase in duty went into effect.

Potassium Compounds in Larger Supply

THE Department of Commerce announces that, according to data collected at the biennial census of manufactures, potassium compounds to the aggregate value of $9,228,337 were made in the United States in 1927, this being an increase of 52 per cent, as compared with $6,071,146 for 1925, and an increase of 42 per cent, as compared with $6,318,822 for 1923. The chief products of this group in 1927 were potassium bitartrate (cream of tartar), with a production of 7,283,977, lb. valued at $1,669,093, and potassium iodide, with a production of 528,017 lb., valued at $1,896,944.

The statistics for 1927, and 1925 are summarized in the following table. The figures for 1927 are preliminary and subject to such correction as may be found necessary upon further examination of the returns.

	Year	Number of Establishments	Quantity Lb.	Value
Aggregate value	1927	.....	.....	$9,228,337
	1925	.....	.....	6,071,146
Potassium—				
Acetate	1927	4	74,119	$20,879
	1925	4	81,043	$19,220
Bitartrate (cream of tartar)	1927	5	7,283,977	1,669,093
	1925	5	7,072,651	1,472,082
Citrate	1927	5	117,297	$66,609
	1925	7	147,399	$83,540
Iodide	1927	7	528,017	1,896,944
	1926	7	494,935	1,821,259
Other potassium salts, total value	1927	.....	.....	5,574,812
	1925	.....	.....	2,675,045
Inorganic	1927	.....	.....	*4,710,856
	1925	.....	.....	2,345,849
Organic	1927	.....	.....	*809,661
	1925	.....	.....	329,196
Not specified as to kind	1927	.....	.....	$54,295

*Named in order of value and number of establishments reporting for each kind valued at more than $10,000: Inorganic—chloride, 4 establishments; hydroxide, 31 carbonate, 2; bichromate, 3; bromide, 2; nitrate, 3; permanganate, 1; phosphate, 2; bromate, 1; perchlorate, 1; hypophosphite, 1; Organic—xanthate, 3; Rochelle salts, 3; tartar emitic, 3; glycerophosphate, 2.

Imported Caustic Potash Offers Competition

WHILE there was a substantial decrease in importation of caustic potash as compared with 1927, the imported material offered keen competition in domestic markets and controlled the situation from a supply standpoint. Demand for this chemical has shown moderate growth and deliveries of the liquid material are reported to be growing in favor. Figures for domestic production of caustic potash are not available but judging from the volume of imports in recent years, consuming requirements must approximate 13,000,000 lb. Prices showed some variation during the year but net changes were small.

Lower Average Price for Liquid Chlorine

By R. T. Baldwin

Secretary, The Chlorine Institute, Inc.

THE year 1928 has been an interesting one for this industry. The yearly capacity, about 190,000 tons chlorine gas basis for sale including three new plants built or building, is, as usual, well in excess of consumption. The average market price has declined about 25 per cent and there is no lack of competition. There have been increases in use for liquid chlorine in the manufacture of ethylene glycol and amyl alcohol and in the application to sewage, industrial wastes, water purification, and "slimes" in paper mills.

The industry, as always, is confronted with a cruel scheme of nature whereby it must make three widely differing substances, chlorine, caustic soda and hydrogen. A little chlorine goes a long way, electrolytic caustic soda is about 25 per cent of the caustic soda business, and hydrogen, unless it can be absorbed in a nearby synthetic ammonia plant, is largely wasted. Numerous persons with good intentions still insist that it is a caustic soda industry. It never will be until the nearly equivalent chlorine can be made and sold profitably and that day is still remote. In a perfect scheme of things the industry should make all the hydrochloric acid and also furnish hydrogen for hardening fats. Economics are against such practices, although the oxidation of ammonia to nitric acid seems likely to alter the position of non-synthetic hydrochloric acid.

Bleaching powder manufacture continues to decline as liquid chlorine supplants it in use. The change, and it cannot be too often repeated, yields not one pound of additional chlorine business, and he is indeed a fortunate maker who has his bleaching powder plant charged off.

Marked Gains in Output of Liquid Chlorine

THE trend toward production and consumption of chlorine in liquid form has been marked for some years and the extent of this change is clearly shown by the statment that production of liquid chlorine in 1927 had increased more than 72 per cent over that for 1925. Some of the industries which are large buyers of chlorine have not been in as favorable position recently as was reported for the majority of industries and this has worked against large expansion in consumption of chlorine and makes it evident that the gain in liquid chlorine distribution has been partially at the expense of bleaching powder.

Production of liquid chlorine for the last five census years was as follows:

Liquid Chlorine Production

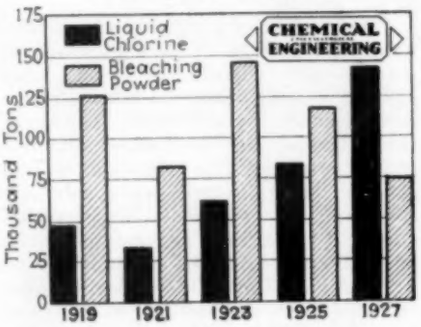
	Tons
1919	45,570
1921	37,985
1923	62,685
1925	83,163
1927	143,205

Production of bleaching powder in 1925 had declined to 115,438 tons as compared with 146,975 tons for 1923. The decline in output of bleaching powder has been pronounced since 1925 but later figures are not yet available.

With the larger output of liquid chlorine prices have shown an easier tendency and contracts for 1929 delivery were written at the lowest level at which this material had ever been offered. Stocks of both liquid chlorine and bleaching powder were reported to have been large for a brief period last year but the market was free of selling pressure.

Revival in export trade in bleaching powder was indicated during the period.

CHLORINE AND BLEACHING POWDER



U. S. Census Bureau Production Figures

The first ten months exports of bleaching powder exceeded the entire 1927 exports. For the year the estimated gain over 1927 is nearly $70,000 or about 22 per cent. The bulk of these exports (90 per cent) go to North and Central America and the West Indies. Canada took 82 per cent, a gain over the previous period, and Cuban purchases accounted for 12 per cent, which were 40 per cent less than formerly.

Research Aids Progress of Naval Stores

By J. E. Lockwood

Director of Sales, Naval Stores Division Hercules Powder Co.

DEVELOPMENTS during 1928 in naval stores of the steam-and-solvent wood products class continued along similar lines to the previous year, with the exception of the commercial production and supply of several new products resulting from the long and extensive research work which this class has done.

Production of wood rosin, steam distilled wood turpentine and pine oil continued at about eighty per cent capacity of the plants operating. Consumption of these products showed some further increase but continued less than production. Stocks at plants in consequence showed further increase, with the sole exception of turpentine stock which decreased. Total plant stocks at close of the year, in round figures were: wood rosin, 110,000 bbl. (500 lb.); turpentine, 6,000 bbl. (50 gal.); pine oil, 800,000 gal.

The noteworthy new development was the commercial production and supply of grade I wood rosin, which was first announced in February, also grade B wood rosin. These new rosins have superior quality and have been received with much favor by consumers.

The development and commercial production of several new terpene derivatives has also opened new uses and wider markets to naval stores. While this as yet is only the beginning of practical results from the long and extensive research work done by this class of naval stores producers, it is however increasingly evident that the discovery of new uses and developments of new products through research by producers and co-operation with consumers, is what the naval stores industry needs to make its products more valuable.

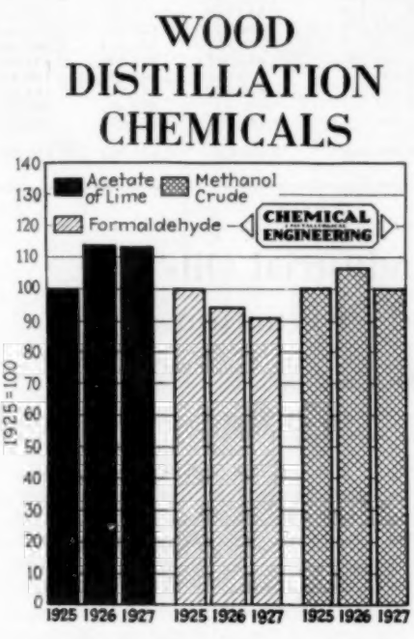
Production of Nitrogen and Fixed-Nitrogen Compounds

	Year	Number of Establishments	Unit of Measure	For Sale — Quantity	For Sale — Value
Aggregate value[1]	1927	..	....	.....	$24,253,798
	1925	..	....	.....	29,659,414
Ammonium group, total value	1927	..	....	.....	$11,560,451
	1925	..	....	.....	15,068,005
Ammonia, aqua	1927	11	Lb.	46,102,198	$1,241,100
	1925	17	Lb.	66,227,955	3,027,474
Ammonia, anhydrous	1927	16	Lb.	45,233,070	4,030,496
	1925	16	Lb.	31,724,858	6,771,876
Ammonium sulphate	1927	10	Lb.	12,077,581	259,589
	1925	10	Lb.	5,708,984	153,134
Other ammonium compounds[2]	1927	..	....	.....	6,029,266
	1925	..	....	.....	5,115,521
Cyanogen compounds, total value	1927	..	....	.....	6,779,032
	1925	..	....	.....	6,663,988
Ferric ferrocyanide (Prussian blue)	1927	19	Lb.	4,104,233	$1,364,537
	1925	26	Lb.	4,971,486	1,619,509
Sodium and potassium ferrocyanides and sodium, silver, and other cyanides	1927	..	....	.....	4,335,725
	1925	..	....	.....	4,156,378
Hydrocyanic acid	1927	6	Lb.	2,283,395	1,078,770
	1925	7	Lb.	2,288,598	888,101
Nitric acid	1927	50	Ton	28,722	3,559,436
	1925	53	Ton	26,852	3,559,695
Nitrous oxide	1927	9	Gal.	65,625,000	798,318
	1925	10	Gal.	54,882,000	729,534
Other nitrogen compounds and gaseous nitrogen	1927	..	....	.....	1,556,561
	1925	..	....	.....	3,638,192

[1]Not including alkaloids, coal-tar derivatives, pyroxylin, rubber substitutes, explosives, nor ammonia products of the coke and manufactured gas industries.

[2]Principal compounds named in order of value for 1927: Phosphates, chloride, carbonates, nitrate, bifluoride, etc.

Reserve Stocks of Wood Chemicals Greatly Reduced



Dept. of Commerce Production Figures

THE WOOD distillation branch of the chemical industry was in an unsettled position throughout the greater part of last year. With fairly large stocks of wood distillation chemicals on hand at the beginning of the year and with increased production of synthetic methanol overshadowing the market, producers of wood distillation products found it difficult to map out a production program which would keep their offerings within the bounds of consuming requirements. The possibility of synthetic acetic acid manufacture getting underway on a large scale further complicated the situation.

The conservative policy of reducing surplus holdings through a restriction of productive activities seemed to be the safest course and this was generally followed throughout the industry. As the year advanced it was seen that producers were meeting with success in their efforts to work off excess stocks but unusually heavy buying from different consuming industries was encountered and it became evident that competitive influences were not strong enough to discourage an enlargement of operations. Production of synthetic methanol had lived up to its promise to gain in volume but offerings were absorbed and the movement wood distillation methanol continued to exceed the output. Later in the year synthetic acetic acid was offered in the market, yet the supply from all sources was inadequate to meet the demand.

IN THE latter part of the year, reserve stocks of wood distillation chemicals had been so depleted that consumers found difficulty in filling their needs. Higher price schedules were put into effect and the market turned decidedly in buyers' favor. Makers of acid, manufacturers of acetates, and the rayon industry were competing keenly for supplies of wood chemicals. The lacquer trade also was an active buyer and regular deliveries of denaturing grade of methanol were passing to the alcohol trade.

As it is necessary to have on hand supplies of properly dried wood before carbonization can be started, it was impossible for most of the plants which had been closed, to start up at short notice and considerable time intervened before producers were able to make material gains in their output. In the closing month of the year, however, the situation showed signs of righting itself and it was expected that production in a short time would be placed on a basis capable of assuring an adequate supply.

Conditions as reported in domestic markets found a counterpart in Canada and during the period of stringency in stocks, offerings from Canadian producers were correspondingly limited.

IN Germany, where synthetic methanol was first produced on a commercial scale, the wood distillation industry has been recovering from the depression which followed the newly created competition. Recent reports from Berlin state that the two controlling wood distilling factors in that country are gradually increasing their outputs and are reaping larger financial returns.

Closed cartel relationships within the wood distillation industry in Germany, especially with reference to marketing, are credited with having strengthened it. The arrangement for communal selling of methanol is believed to be progressing on a satisfactory basis and the market has been expanded considerably by demand for methanol by the electrical industry for use in production of formaldehyde insulating plastics.

In addition to the active call for wood chemicals from the home trade, American producers also experienced heavier buying from foreign countries. In the last quarter of the year, outward shipments were held in check by the limited offerings, exports of acetate in lime for the first ten months of the year amounted to 11,128,580 lb. which compares with 8,879,188 lb. for the first ten months of 1927. Japan takes more than one-half of our exports of acetate of lime, the United Kingdom takes about one-quarter, and Italy and the Netherlands each receive about one-tenth of our export shipments.

Exports of methanol last year gained much more relatively than did those for acetate of lime and were the largest for any year since 1924. On the other hand, imports of methanol showed a decided falling off and gave evidence of the degree to which the domestic synthetic product had supplanted that of German origin. Imports of methanol in 1927 reached a total of 1,718,414 gal., while in the first nine months of 1928 only 182,873 gal. was brought into this country and during the same period 443,354 gal. was exported. There were no importations of methanol from March until September when 54,710 gal. was brought in, the renewal of foreign shipments undoubtedly having been influenced by the scarcity of domestic stocks.

Methanol Position Showed Improvement

METHANOL, produced in the wood distillation industry, entered the year in a rather unfavorable position as competition from the synthetic product had reduced consuming outlets and had a restricting influence on productive activities. The market showed very little change in condition during the first half of the year with the exception of a lowering price trend. Renewed buying interest then appeared and

Production, Shipments and Stocks of Methanol

1928	United States — Crude — Production	Crude — Stocks, End of Month — At Crude Plants	Crude — Stocks, End of Month — At Refineries and In Transit	Refined — Production	Refined — Shipments or Consumption	Refined — Stocks End of Month
January	699,551	344,798	1,126,152	496,073	482,666	455,316
February	642,855	363,325	1,132,377	390,099	407,351	467,723
March	707,460	333,496	1,079,047	442,023	469,308	412,597
April	657,253	323,183	1,120,970	468,446	412,597	430,298
May	609,604	299,062	909,620	557,780	492,081	505,299
June	510,627	289,433	558,483	603,247	596,502	541,083
July	518,220	285,139	277,077	541,113	667,549	444,496
August	501,893	224,267	160,156	436,811	497,971	396,730
September	452,750	196,665	164,972	355,353	415,340	300,478
October	591,369	291,672	161,723	487,384	493,712	325,914
November	696,013	265,102	167,012	536,782	494,047	422,640
Total	6,587,595	.....	.....	5,315,111	5,429,124	.....
	Canada					
January	47,234	39,249	56,104	38,700	17,775	29,198
February	45,659	46,158	55,298	44,850	35,986	33,044
March	47,377	55,776	47,268	48,400	11,505	48,413
April	35,768	32,773	55,934	46,000	39,856	47,311
May	28,505	33,357	57,270	30,400	14,528	55,359
June	27,741	34,950	73,955	6,200	11,462	45,733
July	14,885	38,486	66,518	10,800	12,672	39,210
August	.....	37,933	64,817	14,700	22,076	26,715
September	18,816	13,665	67,314	38,600	25,396	33,101
October	45,768	34,399	57,814	56,700	48,330	23,339
November	53,146	19,682	53,426	39,500	42,989	21,750
Total	364,899	.....	.....	374,850	282,575	.....

values took on a stronger tone as shipments to consumers not only absorbed new production but also brought sharp reductions in stocks at producing points and at refineries. This change in the statistical situation had a strengthennig effect on values with the result that crude methanol sold at higher levels in December than in the corresponding month of last year and refined methanol had gone back to the price level which was in effect at the first of the year.

Synthetic methanol was manufactured on a steady basis throughout the year. Rumors of new production by processes which would greatly lower costs were heard at intervals bus competition among producers failed to develop any price-cutting competition.

Production and stocks of methanol of wood distillation manufacture are given in the accompanying table:

Formaldehyde Closed Year at Higher Prices

A REVIEW of the formaldehyde market for last year places in the important development in the net increase which was registered in the sales price. The strength in values came as a result of higher producing costs and throughout the period prices for formaldehyde moved in close harmony with those for methanol. Demand for formaldehyde was fairly active and export buying was considerably larger than it had been in 1927. While domestic production lagged at periods it is estimated that the year's output was slightly in excess of that for the preceding year. In 1927 domestic production was reported at 29,920,072 lb. as against 31,953,204 lb. and 29,963,927 lb. for 1926 and 1925 respectively.

Active Call Developed for Acetate of Lime

BEGINNING the year, acetate of lime was in a comparatively easy position with a large supply in sellers' hands. Stocks continued to accumulate during the first quarter of the year and prices were none too steady. Production was then curtailed to a point where shipments exceeded production and reserve stocks were drawn upon to fill orders. The rayon industry was a heavy buyer throughout the period and with other consuming industries coming into the market in an active way, visible supplies were greatly reduced and in the latter part of the year a strong situation developed which not only was reflected in an upward revision of prices but also in a stringency of stocks for prompt shipment. As the year drew to a close, producers were operating on a larger scale but there was every indication that a firm market would rule over the first quarter of 1929.

Figures showing production, shipments, and stocks at the end of each month will be found in the accompanying table.

United States and Canada Production of Acetate of Lime

	United States			Canada		
	Production	Shipments	Stocks, End of Month	Production	Shipments	Stocks, End of Month
January	12,519,188	11,342,849	17,596,333	1,109,344	830,643	2,839,640
February	11,717,836	9,081,031	20,227,559	1,090,707	507,160	3,459,197
March	13,022,129	11,232,836	22,102,794	1,152,373	487,601	4,062,476
April	11,693,048	13,151,815	20,516,127	944,248	1,635,771	3,083,610
May	10,986,859	15,386,253	16,204,609	704,352	683,688	3,095,060
June	9,342,227	10,175,185	15,127,692	719,705	887,023	2,848,386
July	9,340,152	13,301,976	11,411,300	442,808	882,396	2,332,841
August	9,149,765	12,503,893	8,054,215	None	2,098,071	140,427
September	8,235,004	12,919,590	3,326,264	445,522	347,967	183,161
October	9,956,891	9,781,861	3,120,711	999,155	990,486	348,776
November	11,699,059	12,536,872	2,301,976	1,241,807	1,123,097	282,724
Total	117,662,158	131,414,161	139,989,580	8,850,021	10,473,903	22,676,298

Consumption of Industrial Oils and Fats Exceeded Production

By John B. Gordon

Secretary, Bureau of Raw Materials for American Vegetable Oils and Fats Industries

PRODUCTION of edible oils and fats in the United States for the year 1928 from domestic grown materials on the basis of the first three quarters production, will amount to about 4.165 million pounds. This production will be divided roughly into one-third animal fats and two-thirds vegetable oils and fats. Consumption of these edible oils and fats in the United States will run about 3,117 million pounds. Of our surplus, therefore, we must export about 1,000 million pounds. These exports are largely made up of hog lard.

Industrial oils and fats of purely domestic origin, i.e., those oils and fats used for some kind of manufacturing operation and not fit for edible usage, and which are made from domestic grown materials, were produced in the amount of 1,789 million pounds in the year 1928. The exact amount cannot, of course, be given at this writing, and it will be understood that all figures given here are based on the production, consumption, etc. for the first three quarters of the year 1928.

Consumption of all industrial oils and fats in the United States ran far ahead of production in the year 1928 as has been the case for many years back. This total consumption amounted to 3,040 million pounds. The demand exceeded domestic production (from purely domestic materials) by 1,250 million pounds. This shortage in the domestic supply was made up by raw materials of oleaginous nature imported from various foreign countries, chiefly the Orient, Africa and South America.

A SHORTAGE of a billion and a quarter pounds of oils and fats of domestic origin is about normal. In fact, had the demands of domestic industry been a bit heavier than they were in 1928, the country would have had to import an additional quarter billion pounds, as it is necessary to meet not only normal consuming demands, but in times of brisk demand, to carry on hand stocks which will prevent the market in oils and fats from skyrocketing.

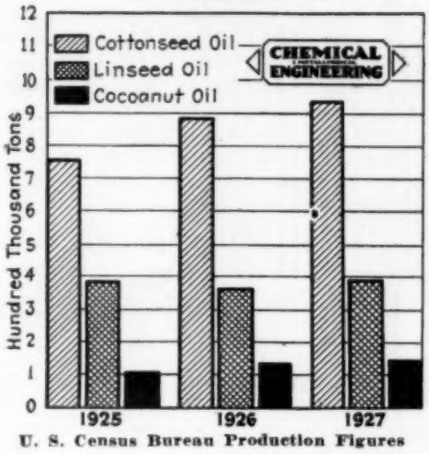
In connection with the discussion of oils and fats of purely domestic origin, it should be stated that the supply of these was not increased in 1928. Nor was it expected that this supply would be increased, owing to the fact that regardless of demand the production of the materials from which these oils and fats are made remains constant.

Our domestic oil and fat supply comes mainly from packing house greases, tallow made by renderers from restaurants and butcher shop scraps, garbage grease from cities, the foots (or offal) from the refining of vegetable oils for edible purposes, a small amount of marine animal oils, and a relatively small amount of flaxseed produced in the northwest. Every one of these items is a byproduct, or, worse yet, an offal product with the exception of the last item, flaxseed, from which linseed oil is made. It is grown for the purpose of producing vegetable oil and the supply capable of expansion within certain limitations, which chiefly consist of the demand for drying oils, and prices of wheat—the chief competing crop in the producing area. In this age of efficiency about everything has already been saved in the way of offal which is practicable, and the tendency is for the pendulum to swing in the opposite direction, it being recognized that the returns from certain inferior classes of offal, such as garbage, often render its destruction cheaper than attempts at reclamation.

Were it not for the fortunate production of oils and fats of vegetable origin in quarters of the world where conditions of a more primitive nature exist than in America, the industries which require oleaginous materials for raw materials would have been in a very bad way indeed in the year 1928.

EVEN our high priced edible oils and fats were produced in the year 1928 as byproducts. This again is a normal condition. Cottonseed oil was our chief edible fat and it was produced as a byproduct from the cotton plant grown for its lint. Hog lard comes

VEGETABLE OILS



U. S. Census Bureau Production Figures

next and it was a byproduct of the preparation of pork for the market, and corn oil, the last important domestic edible oil came as a byproduct from the manufacture of cornstarch and glucose. It may be stated without fear of contradiction, that every pound of edible vegetable and animal fat produced in America in 1928 was not produced by intent, but as a byproduct. It should be understood, of course, that in this discussion no reference is made to butter, which is in a separate and distinct field from other edible oils and fats. Those who merchandise it, or produce it are an entirely different group from the traders in the ordinary run of edible oils and fats.

Prices of oils and fats in the United States in 1928 were quite stable. In fact, the markets might almost have been said to have been monotonous. This condition was world wide. Consuming trades everywhere could see ahead no condition which promised a shortage in any particular quarter, and this always makes for slowness. It requires a forewarning of unsettled conditions, crop shortages and the like, to put zest into oils and fat markets. A survey of the price trends which are kept by this trade association shows nothing worthy of particular comment. Cocoanut oil started the year slightly above 8c., drifted slightly below for some months, and has now almost climbed back into its old position. Inedible tallow has been quite firm of late months, but price levels have departed but little from the start of 1928.

China wood oil, a stellar performer in 1927, has been a meek lamb through 1928. This, of course, was due to more settled conditions in the producing regions during the year just past.

THE status of the vegetable oil industry continued along the definite lines which it began about the year 1922. It grows harder for a manufacturing concern to make fair profits in the industry each year, and the tendency is towards concentration. Several great amalgamations have taken place in the soap industry in the year and a similar trend seems about to get under way in other branches of the industry, notably the paint and varnish field.

The concentration of merchandising activities, manufacturing endeavor, export endeavor and the like, has become a familiar story in American economic life. Its arrival in the vegetable oil industry is belated but now that it is here, it is likely to proceed apace. Its progress will be hastened by the tariff policy in respect to raw materials of foreign origin, adopted by this nation in the Fordney-McCumber Tariff Act of 1922. The individual units of the vegetable oil industries were built up on a basis of moderate priced raw materials. With the departure of low priced raw materials came the need for concentration.

Decline in Cottonseed Oil Consumption

An unusually large carryover of cottonseed oil was reported at the beginning of the 1927-28 crop year. This made up for the falling off in seed production and gave a large supply of oil for the year. In consequence, prices remained at comparatively low levels. Consuming demand made an unfavorable comparison with that for the preceding year. Record holdings of lard had a bearish influence on the oil market for the greater part of the period.

The carryover of oil on July 31, the close of the 1927-28 crop year was approximately 890,000 bbl. or nearly 20 per cent less than on the corresponding date of 1927. The seed supply promises to be larger than in the preceding year and while the movement of seed was late, price fluctuations in the oil market have not been larger and speculative trading in the last quarter of the year was held to relatively low levels because of the narrow circle in which prices moved.

CONSUMPTION of cottonseed oil for the first four months of the 1928-29 season — August-November — amounted to 1,307,109 bbl. as compared with 1,247,746 bbl. in the corresponding period of the preceding season. Refining loss for that period averaged 7.75 per cent as compared with 7.5 per cent for the same period in 1927 and 8.05 per cent in 1926. In the present season the yield of crude oil has averaged 300 lb. per ton of seed. Consumption figures compare as follows:

Consumption Refined Cottonseed Oil
Crop Years 1927-28 and 1926-27

	1927-28 Bbl.	1926-27 Bbl.
August	347,276	185,360
September	374,445	252,788
October	275,319	358,781
November	250,706	345,657
December	222,459	324,438
January	270,056	358,307
February	274,137	339,371
March	375,104	322,030
April	274,168	205,785
May	244,340	286,747
June	219,454	294,565
July	266,067	287,452
Totals	3,393,531	3,561,281

Linseed Oil Consumption Makes Record

WHILE definite figures for consumption of linseed oil in the final quarter of last year are not yet available, the total for the first nine months of the year was almost 76,000,000 gal. and conservative estimates on consumption in the final quarter bring the grand total in excess of 100,000,000 gal. which means that consumption of linseed oil last year was the largest in the history of the trade. The rapid increase in use of pyroxylin lacquers had caused some fears that this would result in a falling off in demand for linseed oil and other materials which enter into paint and varnish manufacture.

The world's supply of flaxseed last year was large enough to take care of consuming without any drastic price changes. The seed situation was reflected in the markets for oil and very little change was noted in quotations.

THE outlook for prices in 1929 would not indicate any radical changes from the levels held in 1928. The United States seed crop is lower with very little more than 20,000,000 bu. promised and the Canadian crop of 3,499,000 bu. is the smallest grown in that country in nearly twenty years. On the other hand, the Argentine is harvesting from a record acreage and the world's supply of seed will not vary much from that of last year. Changes in tariff may become a factor in domestic markets and influence values accordingly but the statistical situation has very little price significance.

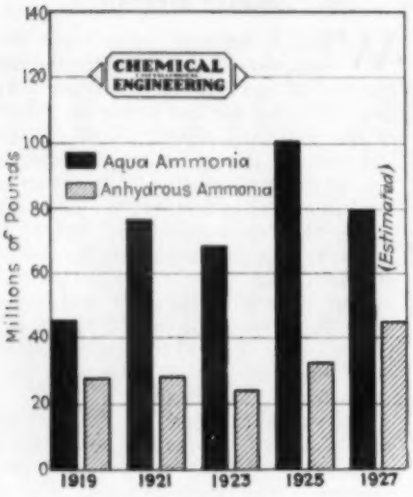
World Trade in Flaxseed

	1925-26 1,000 Bu.	1926-27 1,000 Bu.	1927-28 1,000 Bu.
Exports—			
Argentina	66,835	65,935	75,533
India	7,426	8,255	8,031
Canada	2,541	2,939	2,425
Russia and Danube	1,190	811	83
Imports—			
United States	19,971	24,093	18,160
United Kingdom	14,952	14,257	14,074
Netherlands	14,163	12,156	15,733
Germany	12,445	13,767	18,727
Belgium	3,597	3,439	4,666
France	6,786	6,953	8,011

Larger Importations of China Wood Oil

IN 1927, China wood oil was featured by sharp fluctuations in price. Difficulty was found in moving stocks from the interior of China to shipping terminals and at times offerings for shipment were very meager. In the last year there was an uninterrupted flow of oil from producing points and market prices in China and in domestic markets showed only the usual variations. Imports of wood oil gained in volume during the year and a corresponding increase was reported in consumption. Shipments of wood oil from Hankow to this country in the first eleven months of the year amounted to 93,416,040 lb. as compared with 67,965,975 lb. in the corresponding period of 1927.

AMMONIA



U. S. Census Bureau Figures

Ammonia Products Show Steady Course

CONSUMPTION of ammonia products was in rather close relationship with production last year and the market for aqua and anhydrous while competitive did not develop any signs of the weakness which characterized the market of 1926 when supplies were in excess of demand and values were sacrificed in efforts to reduce holdings. The number of producers of ammonia was reduced in 1927 and the for-sale offerings of aqua ammonia among chemical manufacturers was 46,102,198 lb. as compared with 66,227,955 lb. in 1925. In the latter part of last year a new producer entered the ammonia field and production in the present year may show a gain over that for 1928.

The price tone for both aqua and anhydrous ammonia was steady throughout the past year with a large part of the output passing against contract commitments. A considerable part of this year's output has been sold ahead and this should be a steadying factor unless marked disparity develops between production and consumption.

Consumption of Arsenic Declines

THE failure of cotton growers to buy calcium arsenate in the volume expected has had the effect of cutting down demand for arsenic in the manufacture of insecticides. Glass makers were active last year and sales of arsenic to that industry were on an advancing scale.

Domestic production of arsenic last year is estimated to have reached approximately 9,000 tons and imports amounted to about 10,700 tons. Stocks in the hands of producers are said to have changed but little from the 2,500 tons reported for Jan. 1, 1928. The probable consumption of arsenic, therefore, would figure out at a little under 20,000 tons. In 1927 consumption of arsenic was placed at 22,528 tons and in 1926 at 18,640 tons.

Production and imports of arsenic in 1928 according to months were as follows:

	U. S. Production Refined Tons	Imports Tons
Jan.	827	630
Feb.	668	558
Mar.	688	813
Apr.	669	1,418
May	713	1,413
June	732	1,172
July	728	1,219
Aug.	803	351
Sept.	799	785
Oct.	835	1,392
Nov.	770	491
Dec.	770	
	9,002	10,242

Trading in arsenic during the year was featured by a steadiness in price which was in sharp contrast with the fluctuations which were common in preceding years. The unchanged price level of 4c. per lb. was due partly to the fact that the price was too low to encourage price-cutting especially as the quotation was on a basis of delivery at consumers' works.

German Potash Sales Gain in Volume

SALES of potash by the German Potash Syndicate continue to increase. For the period December to November, inclusive, 1927-1928 sales are approximately 15 per cent greater than for the corresponding period of 1926-27. The following table shows the Potash Syndicate's monthly sales for the two periods above mentioned in metric tons of K_2O:

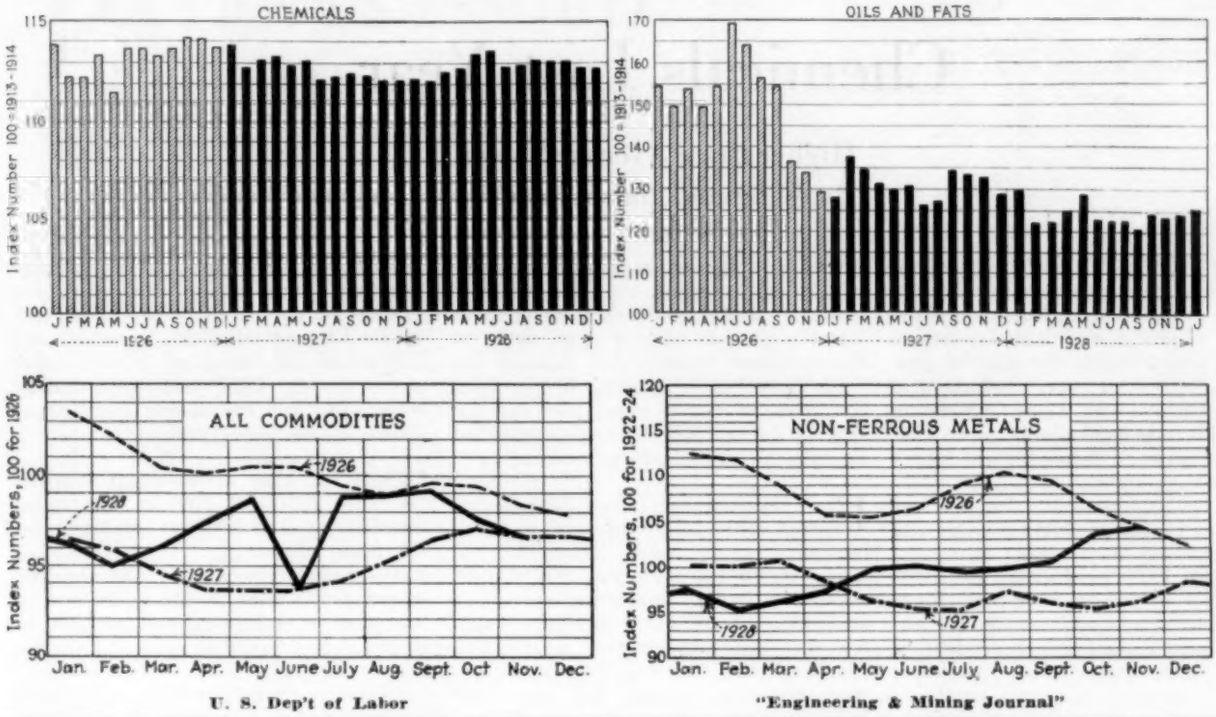
	1926-27	1927-28
December	95,730	100,470
January	190,367	202,010
February	182,837	208,400
March	164,920	161,460
April	50,950	67,414
May	43,070	63,746
June	82,950	99,948
July	88,820	102,608
August	84,550	108,696
September	118,629	140,818
October	63,730	76,507
November	68,353	82,463
Total	1,234,906	1,414,540

Production of Sodium Compounds Census Years 1925-1927

	Year	Number of Establishments	Unit of Measure	For Sale — Quantity	For Sale — Value	Made and Consumed in the Same Establishment, Quantity
Aggregrgate value	1927	..	....	.....	$109,631,524	.....
	1925	..	....	.....	109,522,017	.....
Acetate	1927	6	Lb.	1,147,588	51,799	.....
	1925	7	Lb.	813,834	47,583	.....
Benzoate	1927	6	Lb.	937,070	393,053	.....
	1925	7	Lb.	804,240	372,286	.....
Bichromate and chromate	1927	5	Ton	31,462	3,780,435	.....
	1925	5	Ton	27,820	3,526,568	.....
Borate (borax)	1927	7	Ton	64,864	5,079,278	.....
	1925	7	Ton	49,967	4,083,209	.....
Carbonates:						
Bicarbonate, refined	1927	6	Ton	120,950	3,639,341	.....
	1925	6	Ton	123,472	3,651,848	.....
Sal Soda	1927	19	Ton	54,273	1,336,998	.....
	1925	29	Ton	63,619	1,332,071	.....
Soda ash	1927	11	Ton	1,466,878	29,947,396	571,429
	1925	12	Ton	1,368,660	32,243,941	539,131
Ammonia-soda process	1927	6	Ton	[1]1,402,728	20,645,404	.....
	1925	6	Ton	1,310,882	30,914,558	.....
Natural and electrolytic soda	1927	6	Ton	64,150	1,301,992	.....
	1925	6	Ton	57,778	1,329,383	.....
Modified sodas	1927	7	Ton	44,259	1,438,726	.....
	1925	5	Ton	47,452	1,550,772	.....
Caustic:						
Hydroxide	1927	22	Ton	557,861	28,987,375	26,112
	1925	22	Ton	487,145	27,392,352	10,116
Lime-soda process	1927	6	Ton	[1]397,943	.....	.....
	1925	6	Ton	353,092	.....	.....
Electroiytic process	1927	16	Ton	159,918	.....	.....
	1925	16	Ton	134,053	.....	.....
Repacked caustic (purchased in bulk)	1927	6	Ton	21,104	4,128,433	.....
	1925	12	Ton	26,687	4,414,836	.....
Citrate	1927	5	Lb.	745,249	294,688	.....
	1925	6	Lb.	553,181	249,537	.....
Fluoride	1927	3	Ton	1,534	252,975	.....
	1925	3	Ton	1,252	216,558	.....
Hypochlorite	1927	11	Ton	23,118	1,440,746	.....
	1925	7	Ton	15,392	1,877,257	.....
Iodide	1927	7	Lb.	47,982	208,512	.....
	1925	7	Lb.	49,531	194,803	.....
Nitrate, refined	1927	5	Ton	1,177	104,005	.....
	1925	5	Ton	3,127	221,551	.....
Phosphates	1927	11	Ton	76,069	5,613,053	.....
	1925	13	Ton	79,344	5,755,488	.....
Tribasic	1927	..	Ton	54,447	3,844,750	.....
	1925	..	Ton	48,783	3,288,101	.....
Monobasic and dibasic	1927	..	Ton	21,622	1,768,303	.....
	1925	..	Ton	30,561	2,467,387	.....
Silicate	1927	23	Ton	499,857	6,745,405	.....
	1925	23	Ton	394,884	5,717,426	.....
Silicofluoride	1927	8	Ton	1,646	191,687	.....
	1925	8	Ton	1,384	128,025	.....
Sulphates:						
Niter cake (bisulphate)	1927	38	Ton	108,903	418,617	33,109
	1925	42	Ton	101,596	400,598	22,700
Salt cake	1927	32	Ton	169,063	2,697,960	33,573
	1925	38	Ton	140,843	2,339,002	48,450
Glaubers' salt	1927	20	Ton	54,420	1,081,980	.....
	1925	22	Ton	57,622	1,265,260	.....
Refined anhydrous	1927	5	Ton	2,688	119,111	.....
	1925	5	Ton	2,100	128,115	.....
Hyposulphite (Thiosulphate)	1927	7	Ton	16,656	704,384	.....
	1925	12	Ton	23,982	1,051,068	.....
Sulphide	1927	16	Ton	38,446	1,691,609	8,048
	1925	15	Ton	23,765	1,203,332	5,404
Sulphites:						
Sulphite (normal)	1927	6	Ton	5,030	399,529	.....
	1925	7	Ton	4,492	382,728	.....
Bisulphite	1927	9	Ton	10,510	512,765	4,725
	1925	10	Ton	12,437	609,163	1,266
Other sodium compounds	1927	..	....	.....	8,371,664	.....
	1925	..	....	.....	9,166,640	.....

[1]Preliminary figures revised.

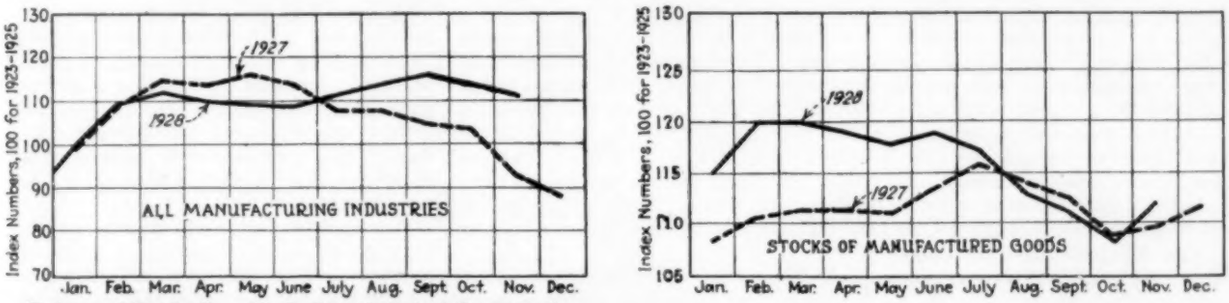
CHEM. & MET. *Weighted Indexes of* PRICES



U. S. Dep't of Labor

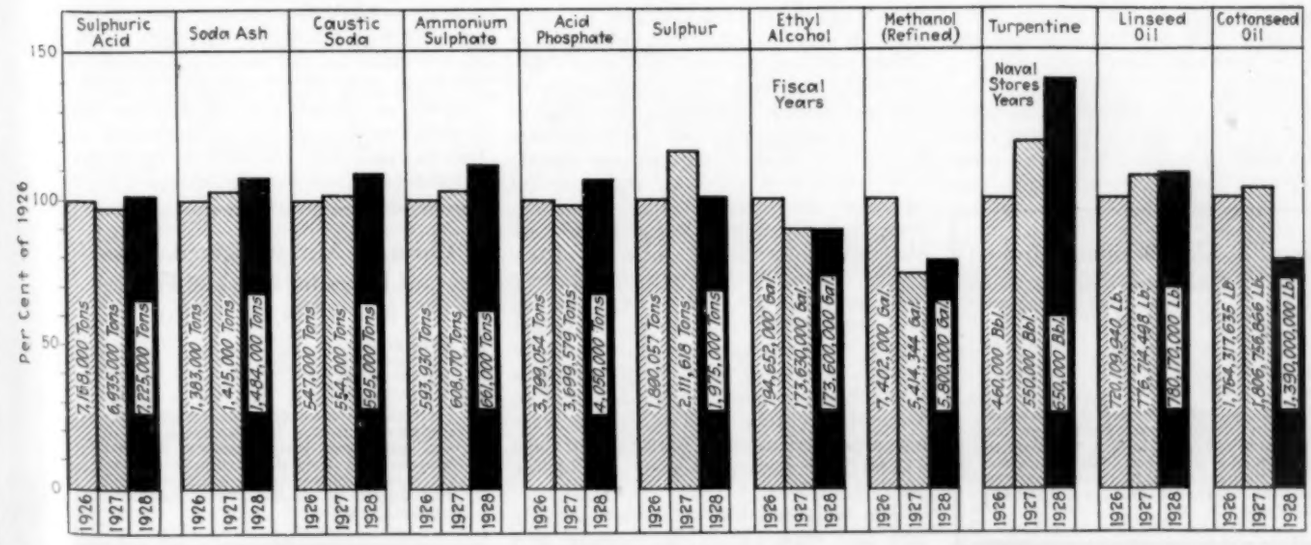
"Engineering & Mining Journal"

PRICES AND OUTPUT IN 1928


Index Numbers, 100 for 1923-1925
1927
1928
ALL MANUFACTURING INDUSTRIES
STOCKS OF MANUFACTURED GOODS
Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.

Volume of Production (U. S. Department of Commerce)

CHEM. & MET. *Estimates of* PRODUCTION *of* BASIC CHEMICALS



Larger Domestic Production of Chemicals Last Year

Higher Price Average Shown By Weighted Index Number

AS CHEMICALS form a part of the essential raw materials for the majority of manufacturing lines, it follows that the volume of chemical distribution will vary according to the state of general industry. Last year, production in basic industries was along expanding lines and ample evidence is given that the consumption of chemicals was larger than in the preceding year. Naturally the increase in consuming demand was reflected in higher production totals and for the industry as a whole it is estimated that 1928 production exceeded that for 1927 by at least 5 per cent. More extensive building operations, larger automotive outputs, increased production of rayon, plate glass, glass containers, paint and varnish, lacquers, fertilizer, refined petroleum, and soap offer ready explanation for the increase in chemical production.

THE year also was memorable because of developments within the industry which demonstrate that technical progress is a prominent factor in directing the industry. During the period domestic production of acetic acid was established on a commercial scale and this material promises to be more of a market factor in the coming year. The output of synthetic methanol was enlarged and it was reported that a new process was utilized through which methanol was obtained from methane present in certain grades of crude mineral oil.

In nitric acid manufacture, there was a material expansion in production through the oxidation of ammonia and plans were in progress for further gains in that direction in the coming year. Incidentally this development had the effect of cutting down production of niter cake.

Perhaps the most important development of the year was found in the completion and operation of a large plant for nitrogen fixation from the air. This offers a domestic supply of nitrogen which is expected to compete with Chilean nitrates and other nitrogenous materials which have a large outlet in the fertilizer trade. Air fixation has made considerable progress in European countries in recent years and has cut sharply into markets formerly controlled by other nitrogen-bearing materials.

IN THE coal-tar group progress is being made in production of intermediates. In the census report for 1927 it was stated that there was conspicuous expansion in the production of rubber accelerators with many products made for the first time in that year. Research also has developed the manufacture of intermediates for fast and specialty dyes and to this may be attributed the growth in dye production both in respect to volume and to variety of offerings.

New production of solvents has been noteworthy in recent years and has been stimulated by the increased consumption of lacquers and pyroxylin plastics. Development in production of synthetic organic chemicals may be inferred from the fact that the output in 1927 was 280,992,825 lb. as compared with 214,842,513 lb. in 1926, or an increase of 31 per cent in the year. Further increases are expected to be revealed when data for 1928 is available.

PRODUCERS of chemicals maintained the policy of distributing a large part of their output on a contract basis. This has a tendency to hold price fluctuations within narrow bounds and many of the more important offerings were quotably unchanged throughout the year. Low priced sulphur contracts had run out and last year's distribution was on a higher average price plane although quotations for sulphur were the same as in 1927. The mineral acids were in a strong position during the period and alkalies, while subject at times to price shading, generally were steadily held. Wood distillation chemicals went through a period of low prices from which a strong recovery was staged when consuming demand was augmented and stocks in sellers hands were not sufficiently large to fill orders. *Chem. & Met.s* weighted index number in January was 112.25 and in December it stood at 112.83. The average weighted number for the year was 112.80 in comparison with 112.74 for 1927.

The weighted index number for oils and fats was 129.76 in January and 124.16 in December. The average weighted number for the year was 123.88 as compared with 131.10 for 1927. Linseed oil, China wood oil, and cottonseed oil were at higher price levels during 1927 and were chiefly responsible for the higher average as shown by the index numbers.

THE working of the flexible provisions of the Tariff act was called into play to secure higher import duties for some chemicals. At the close of the year the tariff question had assumed larger proportions as the belief spread that a more or less general revision in import duties would be asked for during the coming year.

Export trade in chemicals and related products was of a progressive nature in 1928. Total exports for the first ten months of the year were valued at $114,040,421 which compares with a valuation of $110,147,760 for the corresponding period of 1927. The Department of Commerce has given valuable aid in the development of foreign trade not only by furnishing information about foreign markets, methods of trading, credits, packaging, etc., but also by bringing together executives of the domestic industry and focusing their attention to the possibilities for trade offered by foreign markets.

Among the groups in which large export gains were recorded is that of pigments, paints, and varnishes. Exports for the first ten months of the year were valued at $20,897,788 in comparison with $17,559,300 for the like period of 1927.

Import trade in chemicals and related products likewise showed substantial gains during the year. Arrivals at domestic ports in the first ten months of the year reached a valuation of $121,405,468 as against $109,956,945 for the first ten months of 1927. Practically all this increase was represented by larger shipments of fertilizer materials.

Chem. & Met. Weighted Index of Chemical Prices

Base = 100 for 1913-14

This month	**112.69**
Last month	112.83
January, 1928	112.25
January, 1927	112.79

Increased supplies of sulphate of ammonia brought lower prices for that chemical and had a weakening effect on the weighted index number. Strong markets ruled for some of the coal-tars and salt cake commanded higher prices.

Chem. & Met. Weighted Index of Prices for Oils and Fats

Base = 100 for 1913-14

This month	**125.44**
Last month	124.16
January, 1928	129.76
January, 1927	127.35

Crude cottonseed oil closed fractionally higher. China wood, corn, and palm oils were firmer. Animal fats held a firm to strong position. Linseed oil closed in an easy position. The weighted index number was substantially higher.

PATENTS ISSUED
Dec. 4 to Dec. 25, 1928

Paper, Pulp, Glass and Sugar

Apparatus for Boiling Cellulose. Carl Hangleiter, Mannheim-Waldhof, and Adolf Schneider, Kelheim-on-the-Danube, Germany, assignors to the Firm: Zellstofffabrik Waldhof, Mannheim-Waldhof, Germany.—1,693,983.

Charging Apparatus for Pulp Digesters. Elis Olsson, West Point, Va.—1,694,139.

Process of Making Raw Calcium-Bisulphite Digesting Liquor. George A. Richter, Berlin, N. H., assignor to Brown Company, Berlin, N. H.—1,694,231.

Feed Control of Paper-Making Machines and Apparatus Therefor. August Kolitsch, Port Alfred, Quebec, Canada.—1,695,380.

Paper-Making Machine. Leon M. Yoerg, Holyoke, Mass., assignor, by mesne assignments, to American Writing Paper Company, Incorporated, Holyoke, Mass.—1,695,448.

Paper-Making Machine. Harrison R. Williams, Chicago, Ill.—1,695,873.

Paper-Making Machinery. Erik Alexander Ohlin and Frans Oskar Carlsson, Hyltebruk, Sweden.—1,695,972.

Petroleum Refining and Products

Operation of Pressure Stills. John E. Bell, Brooklyn, N. Y., assignor to Sinclair Refining Company, Chicago, Ill.—1,693,946.

Removal of Petrolatum from Oils. Charles Zweig, Wood River, Ill., assignor to Standard Oil Company, Whiting, Ind.—1,694,090.

Art of Converting Hydrocarbon Oils. Oswald C. Brewster, Casper, Wyo., assignor to Standard Oil Company, Whiting, Ind.—1,694,092.

Method of Distilling Petroleum. Henry H. Hewetson, Elizabeth, N. J., assignor to Standard Oil Development Company.—1,694,259.

Process of Converting Hydrocarbons Into Lower-Boiling Products. Frank A. Howard, Elizabeth, N. J., assignor to Standard Oil Development Company.—1,694,262.

Preparing Hydrocarbon Products. Nathaniel E. Loomis, Elizabeth, N. J., assignor to Standard Oil Development Company.—1,694,272.

Fatty Acid and Soap Derived from Mineral Oil and Process of Making Same. Gellert Alleman, Swarthmore, Pa., assignor to Sun Oil Company, Philadelphia, Pa.—1,694,461.

Mineral-Oil Derivatives and Process of Making Same. Gellert Alleman, Swarthmore, Pa., assignor to Sun Oil Company, Philadelphia, Pa.—1,694,462.

Apparatus for Treating Emulsified Oil. Gustav Egloff and Harry P. Benner, Chicago, Ill., assignors to Universal Oil Products Company, Chicago, Ill.—1,694,643.

Process of Combined Absorption and Fractionation for Recovering Gasoline from Gas. Edwin R. Cox and Dexter A. Cushman, Los Angeles, Calif.—1,695,139.

Process for Treating Petroleum Oils. Walter M. Cross, Kansas City, Mo., assignor, by mesne assignments, to Gasoline Products Company, Inc., Wilmington, Del.—1,696,030.

Organic Processes

Purification of Crude Anthracene. Alphons O. Jaeger, Crafton, Pa., assignor, by mesne assignments, to The Selden Research & Engineering Corporation, Pittsburgh, Pa.—1,693,713.

Impregnating Solution. Lawrence V. Redman, Caldwell, N. J., and Harold C. Cheetham, Chicago, Ill., assignors to Bakelite Corporation, New York, N. Y.—1,693,939.

Process of Making Activated Carbon. Arthur Benning Ray, Bayside, Ernest Gardner Doying, New York, N. Y., and John J. Butkovsky, Elizabeth, N. J., assignors to Carbide and Carbon Chemicals Corporation.—1,694,040.

Cellulose-Nitrate Solution. Marion B. Hopkins, Elizabeth, and Hyym E. Buc, Roselle, N. J., assignors to Standard Oil Development Company.—1,694,097.

Catalytic Oxidation of Organic Compounds. Alphons O. Jaeger, Pittsburgh, Pa., assignor to The Selden Company, Pittsburgh, Pa.—1,694,122.

Purification of Benzoic Acid and its Derivatives. Alphons O. Jaeger, Crafton, Pa., assignor to The Selden Company, Pittsburgh, Pa.—1,694,124.

Process of Refining Wood Rosin. George E. Jenks, Bacchus, Utah, assignor to Hercules Powder Company, Wilmington, Del.—1,694,179.

Pitch-Coking Process and Product. Frederick W. Sperr, Jr., Pittsburgh, Pa., assignor to The Koppers Company, Pittsburgh, Pa.—1,694,800.

Catalyst for Synthetic Methanol Production. John C. Woodruff, Grover Bloomfield, and William J. Bannister, Terre Haute, Ind., assignors to Commercial Solvents Corporation, Terre Haute, Ind.—1,695,447.

Process for the Manufacture of Esters. William J. Bannister, Terre Haute, Ind., assignor to Commercial Solvents Corporation, Terre Haute, Ind.—1,695,449.

Phenolic-Resin Composition. Victor H. Turkington, Caldwell, N. J., assignor to Bakelite Corporation, New York, N. Y.—1,695,566.

Chemical Product and Process of Making the Same. Carleton Ellis, Montclair, N. J., assignor to Chadeloid Chemical Company, New York, N. Y.—1,695,636. *Chlorinating rubber.*

Varnish. Carleton Ellis, Montclair, N. J., assignor to Chadeloid Chemical Company.—1,695,642.

Process of Producing Sodium Acetate. Francis G. Rawling, Madison, Wis.—1,695,742.

Fermentation Process. Elliott Ross Weyer, Washington, Pa.—1,696,022.

Purification of Acetic Anhydride. William Pearson Skertchly, Spondon, near Derby, England, assignor to Celanese Corporation of America.—1,696,363.

Manufacture of Acetalydehyde. Carl Nelson Hand, Nitro, W. Va., assignor to The Rubber Service Laboratories Co., Akron, Ohio.—1,696,479.

Process of Extracting Rosin and Turpentine from Wood. Abraham A. Shimer, Brunswick, Ga., assignor to Hercules Powder Company, Wilmington, Del.—1,696,696.

Inorganic Processes

Wet Process for Manufacturing Cement. Werner P. Eckdahl, Chicago, Ill.—1,693,644.

Process for Producing Lithopone Fast to Light. Gustav Jantsch, Bonn-on-the-Rhine, and Paul Wolski, Wiesdorf-on-the-Rhine, Germany, assignors to I. G. Farbenindustrie Aktiengesellschaft, Frankfort, Germany.—1,693,902.

Method of Production of Sodium Bisulphate. John N. Carothers and Charles F. Booth, Anniston, Ala., assignors to Federal Phosphorus Company, Birmingham, Ala.—1,693,947.

Contact Sulphuric-Acid Process. Alphons O. Jaeger, Crafton, Pa., assignor to The Selden Company, Pittsburgh, Pa.—1,694,123.

Base-Exchange Compound and Process of Making It. Harold Joseph Wheaton, Lower Walton, near Warrington, England, assignor, by mesne assignments, to American Doucil Company, Philadelphia, Pa.—1,694,155.

Process for the Manufacture of Aluminous Cements. Louis Gabriel Patrouilleau, Paris, France, assignor to Societe Alumine et Derives, Paris, France.—1,694,338.

Process for the Purification of Gases to be Used in the Production of Ammonia. Birger Fjeld Halvorsen, Oslo, Norway, assignor to Norsk Hydro-Elektrisk Kvaelstofaktieselskab, Oslo, Norway.—1,694,594.

Bonded Refractory. Russell Edmund Lowe, New York, N. Y., assignor to Doherty Research Company, New York, N. Y.—1,694,924.

Method of Producing Elemental Sulphur. Alfred Paul Thompson, Jackson Heights, N. Y., assignor to General Chemical Company, New York, N. Y.—1,695,068.

Fertilizer. George Barsky, New York, N. Y., and Frederick W. Freise, Palmyra, N. J., assignors to American Cyanamid Company, New York, N. Y.—1,695,081.

Production of Pure Carbon Monoxide. Gustav Wietzel, Ludwigshafen-on-the-Rhine, Germany, assignor to I. G. Farbenindustrie Aktiengesellschaft, Frankfort-on-the-Main, Germany.—1,695,130.

Catalytic Oxidation of Sulphur Dioxide. Alphons O. Jaeger and Johann A. Bertsch, St. Louis, Mo.; said Jaeger assignor to The Selden Company, Pittsburgh, Pa.—1,695,285.

Method of Obtaining Titanium Oxide. Reginald Hill Monk, Montreal, Quebec, Canada.—1,695,341.

Process of Producing Hydrochloric Acid Synthetically. Wilhelm Hirschkind, Antioch, and Carl W. Schedler, Berkeley, Calif., assignors to Great Western Electro Chemical Company, San Francisco, Calif.—1,695,552.

Process for the Production of Phosphoric Acid. Albert Noble, Anniston, Ala., assignor to Federal Phosphorus Company, Birmingham, Ala.—1,695,558.

Production of Sodium Nitrate. Robert Griessbach, Ludwigshafen-on-the-Rhine, and Kurt Röhre, Mannheim, Germany, assignors to I. G. Farbenindustrie, Aktiengesellschaft, Frankfort-on-the-Main, Germany.—1,696,197.

Process for Directly Producing Ammonia. Carl Otto, Essen-Ruhr, Germany.—1,696,446.

Process for Evaporating Brines. George B. Burnham, Reno, Neb., assignor to Burnham Chemical Company, Reno, Nev.—1,696,542.

Catalytic Oxidation of Sulphur Dioxide. Alphons O. Jaeger and Johann A. Bertsch, St. Louis, Mo.; said Jaeger assignor to The Selden Company, Pittsburgh, Pa.—1,696,546.

Chemical Engineering Processes and Equipment

Automatically Actuated Brush for Grainer Pipes. Thorvald C. Colbiornsen, Antonito, Colo.—1,693,689.

Tank-Cleaning Device. Arthur B. Butterworth, Port Arthur, Tex.—1,693,885.

Ultrafilter Membrane. Jacques Duclaux, Paris, France.—1,693,890.

Carrying Out Catalytic Oxidations in the Gaseous or Vapor State. Johannes Brode and Adolf Johannsen, Ludwigshafen-on-the-Rhine, Germany, assignors to Grasselli Dyestuff Corporation, New York, N. Y.—1,693,915.

Water Evacuator for Drier Drums. William H. Millspaugh, Sandusky, Ohio, assignor to The Paper & Textile Machinery Co., Sandusky, Ohio.—1,693,934.

Rotary Mixer. Lafayette Henry Nelles, London, England.—1,693,935.

Screening Apparatus. Samuel Davis Robins, Woodmere, N. Y., assignor to Robins Conveying Belt Company, Passaic, N. J.—1,693,940.

Worm Conveyor. Richard Müller, Spandau, Germany, assignor to Krah & Kirchhoff, Berlin, Germany.—1,694,228.

Rotary Drier. Fred A. Jones, Canton, Ohio.—1,694,708.

Recovering Values by Evaporation. Henry W. Carr, San Francisco, Calif.—1,694,841.

Filter Press. Harry L. Walker, Whiting, Ind., assignor to Standard Oil Company, Whiting, Ind., a Corporation of Indiana.—1,694,956.

Apparatus for the Manufacture of Artificial Silk. Joseph Edouard Gustave Lahousse, Lyon, France, assignor to Société pour la Fabrication de la Soie "Rhodiaseta," Paris, France.—1,695,111.

Coating Machine. Lynn B. Case, New Brunswick, N. J., assignor to John Waldron Corporation, New Brunswick, N. J.—1,695,319.

Oil-Storage Tank. Boyd K. Appleman, Beaumont, Tex.—1,695,358.

Mechanism and Process for Separating Intermixed Divided Materials. Kenneth Davis, St. Benedict, Pa., assignor, by mesne assignments, to Peale-Davis Company, Wilmington, Del.—1,695,369.

Apparatus for the Manufacture of Artificial Filaments. Jacques Delpech, Rennes, France.—1,695,455.

Acid-Concentrating Chamber. Otto C. Trautmann, New York, N. Y.—1,695,619.

Drying Apparatus. Sherwood Green, Berkeley, Calif.—1,695,652.

Process of Producing a New Catalyst. Karl Schirmacher and Friedrich Stolz, Hochst-on-the-Main, and Hans Schlichenmaier and Walter Krohs, Soden-on-the-Taunus, Germany, assignors to I. G. Farbenindustrie Aktien-Gesellschaft, Frankfort-on-the-Main, Germany.—1,695,666.

Catalytic Agent and Process of Preparing the Same. Walter A. Patrick, Baltimore, Md., assignor to The Silica Gel Corporation, Baltimore, Md.—1,695,740.

Centrifuge. Ludwig Altpeter, Trier, Germany.—1,695,990.

Apparatus for the Treatment of Solid-Bearing Solutions. Walter L. Remick, Philadelphia, Pa.—1,696,014.

Colloid Mill. Andrew Fraser, Croyden, England.—1,696,083.

Catalytic and Adsorbent Gel. Walter A. Patrick, Baltimore, Md., assignor to The Silica Gel Corporation, Baltimore, Md.—1,696,644-5.

MARKET APPRAISAL OF CHEMICAL INDUSTRY

Price Jan., 1928	Net Gain 1928	Price Range in 1928 High	Price Range in 1928 Low	Sales in Dec.	Stock	Price Range in December Dec. 1	Price Range in December High	Price Range in December Low	Price Range in December Dec. 31
61	37	99¼	59	100,000	Air Reduction	86	95¼	80½	98
11⅛	— 1½	14⅜	7½	104,500	Ajax Rubber Co.	10⅜	10⅜	8½	10⅜
153½	96½	252½	146	91,200	Allied Chemical	244	252½	216½	250
122½	— 1⅜	127⅜	120½	1,300	Allied Chemical, pf	123	123½	121½	121½
19⅜	1⅜	26	15⅜	25,500	Am. Ag. Chemical	22⅜	23	19½	21½
69½	2½	79½	55½	23,400	Am. Ag. Chemical, pf	74½	74½	64½	72
39½	18½	65	30½	107,400	American Cyanamid, B	53	65	43½	58½
10½	— 2	15½	8½	3,000	Am. Hide & Leather	9½	10½	8½	8½
63½	116½	192	56½	900	American Linseed	180	192	165	180
86	94	182	86½	339	American Linseed, pf	180	182	180	180
46½	15½	63½	39	85,300	American Metal	58⅞	62½	51⅜	62
14½	1½	24	13	70,500	Am. Rayon Products	20½	20½	15	15⅜
30	— 2½	28½	11½	20,500	Am. Solvents & Chemical	26⅜	28	23½	27½
60½	— 27	54	26½	5,300	Anglo-Chile Nitrate	33⅜	34	29	33¼
61½	40⅜	112⅜	55⅛	49,300	Archer-Daniels-Midland	103½	110	95½	102
....	....	33½	19½	14,300	Ass. Dyeing & Printing	28½	28½	19½	21½
63	49	114	63	61,100	Atlas Powder	93½	114	93	112
16	5⅜	24½	12½	170,200	Beacon Oil	21½	24½	21	21⅜
73½	22⅜	101½	70½	86,600	Beechnut Packing	84⅜	101½	80	96
65½	18⅜	85⅜	65½	16,200	Bon Ami, A	78½	85½	77	84
....	....	97⅜	65	10,800	Bristol-Myers	94	95⅜	85	94⅜
....	....	36	25⅜	50	Calif. Petroleum	....	28	27	....
100	— 46½	103	36½	37,400	Celanese Corp	45	59⅜	36½	53⅜
....	....	112	91	900	Celanese Corp., pf	....	99½	91	91
54½	— 26	64½	23½	65,800	Certainteed	29½	30⅜	23½	28½
50	....	56½	45	16,300	Chickasha Cotton Oil	50	51	45	50
169⅜	69½	250⅜	137⅜	43,300	Commercial Solvents	237½	240½	208	239
64⅜	26	146⅜	46⅜	107,200	Corn Products	91½	92½	86	90
46⅜	13½	68⅜	34⅜	100,400	Davison Chemical	65⅜	65⅜	53⅜	59½
40	16	61	40	15,200	Devoe & Raynolds	56	60⅜	52⅜	56
114	— 2	120	108	150	Devoe & Raynolds, pf	112½	115½	112	112
319	181	503	310	17,500	Du Pont	490½	502	455	100
120	— 2	121½	114	2,900	Du Pont, 6 p.c. db	118⅜	120	118	518
164½	18½	194½	163	18,800	Eastman Kodak	186	186	176½	183
228	14½	259	166	13,455	Firestone Tire	195	259	189½	242½
16½	— ½	17⅜	8⅜	160,100	Fisk Rubber	15	16⅜	12	16⅜
71	12⅜	89⅜	65	223,000	Fleischmann	84⅜	84⅜	75½	83½
103	— 53½	109½	43	176,000	Freeport Texas	47⅜	52⅜	43⅜	49½
23⅜	13	37	20⅜	175,500	Glidden	35	37	30½	36⅜
94½	9	105	95	390	Glidden, pf	104½	104⅜	102⅜	103½
73	69½	143½	71	681,100	Gold Dust	136	143½	123	142⅜
93½	10	109½	68½	500,400	Goodrich Co	85⅜	109½	79	103½
155	— 57	167	79	100,100	Houston Oil	133	133½	79	98
134⅜	— 1⅜	146	118	14,100	Industrial Rayon	132½	139	118	133
15⅜	— ⅛	20⅜	13	18,800	Int. Ag. Chemical	16½	17½	13½	15⅛
60	25	85	48⅜	6,600	Int. Ag. Chemical, pf	82	85	80	85
73	— 14½	86⅜	50	13,400	International Paper	56⅛	59⅜	54½	58½
70	— 14	68⅜	49½	680	International Salt	57½	59	52	56
26	— 2½	25½	19⅜	451,800	Kelley-Springfield	24⅛	24½	19⅜	23½
17½	5⅜	26½	17½	73,100	Lee Rubber & Tire	21	24	18½	23½
38⅜	24⅜	64⅜	38	84,300	Lehn & Fink	60½	64½	54	63⅜
....	....	186	109	9,595	Libby-Owens	170½	185	155	181
77½	29⅜	124½	63½	12,230	Liquid Carbonic	120½	122½	95	107
124½	57½	190	117⅜	14,600	Mathieson Alkali	169½	190	168½	182
....	....	98	38½	550	Monsanto Chemical	....	98	92	....
52½	— 14⅜	58½	29⅜	40,100	Nat'l Dist. Products	42	43⅜	32½	37⅜
129	1½	136	115	11,800	National Lead	128⅜	134	118⅜	130½
184½	99½	294	180½	2,300	New Jersey Zinc	239	294	239	294
65⅜	16⅜	83½	58½	39,700	Ohio Oil	79⅜	80½	71	72⅜
74½	7½	95½	74½	18,700	Owens Bottle	88	90	79	81⅜
94½	....	123⅜	85	.....	Palmolive Peet	....	....	....	....
41	4	53⅜	35½	192,300	Phillips Petroleum	50½	50⅜	43⅜	45
211	....	300	210	.....	Pittsburgh Plate Glass	....	....	....	....
52⅜	13½	72½	51½	9,000	Pratt & Lambert	70	70⅜	61⅜	66
26	1	31½	19	161,400	Pure Oil	29⅜	29½	25⅜	27
....	....	92	65⅜	25	Sherwin-Williams	89	89	89	....
19½	2⅜	29	17	7,100	Silica Gel	25⅛	25⅜	21½	22⅜
20⅜	21½	46½	17⅜	2,000,500	Sinclair Oil	45⅛	45⅜	35	42½
27½	7⅜	42⅜	25	98,500	Skelly Oil	40⅛	40⅜	34½	35½
55⅜	16½	80	53	265,100	Standard Oil, Cal.	76⅛	76⅜	66	72
39⅜	15½	59⅜	37⅜	561,300	Standard Oil, N. J.	59	59	50	55
31½	14½	45⅜	28⅜	1,973,100	Standard Oil, N. Y.	41½	45½	37	45½
2⅜	1½	7⅜	2⅜	9,500	Standard Plate Glass	4⅛	5	4	4⅛
31⅜	33½	77	31½	25,300	Sun Oil	75⅛	75⅛	62⅜	....
17½	1½	23½	16	200	Swan & Finch	....	21	18⅜	....
10⅜	8½	19½	10½	170,000	Tenn. Copper & Chemical	18½	19½	16½	19
54⅜	12⅜	74½	50	288,800	Texas Corp.	68½	68⅜	63⅜	67
77⅛	1⅜	82½	62⅜	449,200	Texas Gulf Sulphur	76⅜	80⅛	68⅜	79½
17½	19½	25	14⅜	43,800	Tidewater Oil Assn.	23½	24	19½	21½
460	60	630	450	3,980	Tubize Silk	549½	614	520	520
145	52	209	136½	290,400	Union Carbide	200	203	174⅜	197
44	6½	58	42⅜	62,900	Union Oil, Cal.	54⅜	55⅜	49⅜	50½
....	....	120	52½	7,000	United Piece Dye	109	111	102½	105⅜
109½	21⅜	138	102½	121,000	U. S. Ind. Alcohol	132⅜	136½	125½	131½
22½	10⅜	51	22	51,700	U. S. Leather	32⅜	35⅜	31½	33
56	— 9½	63½	27	355,700	U. S. Rubber	41	48	38½	46⅜
....	....	111	72	68,600	Vacuum Oil	97⅜	111	92½	109⅜
64⅜	37½	111½	60	170,400	Vanadium Corp	102½	104⅜	85	101⅜
59½	25½	85	58	47,200	Vick Chemical	77	85	70⅜	85
14	4⅜	20⅜	12	61,900	Va.-Ca. Chemical	18⅜	19⅜	15⅜	18⅜
47½	12⅜	64½	44½	14,000	Va.-Ca. Chemical, pf	60⅜	60⅜	52	60½
....	....	110	87	83,200	Wesson Oil	98	110	92	96½
11½	½	16	11	21,500	Wilson & Co	12⅜	13⅜	11½	12

Comparative Prices in New York Market, 1928

The following prices refer to round lots in the New York market. Where it is the trade custom to sell f.o.b. producing points, the quotations are given on that basis and are so designated. The figures show the opening price, the high, the low and the closing price for 1928.

Industrial Chemicals

			Jan. 1	High	Low	Dec. 31
Acetone, drums		lb.	$0.12	$0.14	$0.12	$0.14
Acid, acetic, 28% bbl	100	lb.	3.38	3.88	3.38	3.88
Boric, bbl		lb.	.08½	.08½	.06½	.06½
Citric, kegs		lb.	.44½	.46	.44½	.46
Lactic, 44%, tech., light, bbl		lb.	.13½	.13½	.12	.12
22% tech., light, bbl		bbl.	.06½	.06½	.05½	.05½
Muriatic, 18- tanks	100	lb.	.85	.85	.85	.85
Nitric, 36- carboys	100	lb.	5.00	5.00	5.00	5.00
Oxalic, crystals, bbl		lb.	.11	.11	.11	.11
Sulphuric, 60-, tanks		tons	10.00	11.00	10.00	11.00
Tartaric, powd., bbl		lb.	.36	.37½	.35½	.37½
Alcohol, ethyl, 190 p'f. U.S.P., bbl		gal	3.70	3.70	2.69	2.68
Alcohol, denatured, 190 proof						
No. 1 special dr		gal.	.48	.48	.43	.48
No. 5, 188 proof, dr		gal.	.48	.48	.43	.48
Alum., ammonia, lump, bbl		lb.	.03½	.03½	.03½	.03½
Potash, lump, bbl		lb.	.02½	.03	.02½	.02½
Aluminum sulphate, com., bags	100	lb.	1.40	1.40	1.40	1.40
Aqua ammonia, 26-, tanks		lb.	.03	.03½	.03	.03½
Ammonia, anhydrous, cyl		lb.	.13½	.13½	.13½	.13½
Ammonium carbonate, powd. tech., casks		lb.	.10½	.12	.10½	.12
Ammonium sulphate, wks	100	lb.	2.40	2.70	2.30	2.30
Amylacetate tech., drums		gal.	1.75	1.75	1.75	1.75
Arsenic, white, powd., bbl		lb.	.04	.04½	.03½	.04
Arsenic, red, powd., kegs		lb.	.09½	.09½	.09	.09
Barium carbonate, bbl		ton	50.00	57.50	48.00	47.50
Barium chloride, bbl		ton	56.00	63.00	55.00	63.00
Barium, nitrate, casks		lb.	.08½	.08½	.07½	.07½
Bleaching powd.,f.o.b. wks.,drums	100	lb.	2.00	2.00	2.00	2.00
Borax, bbl		lb.	.04	.04	.02½	.02½
Calcium acetate, bags	100	lb.	3.50	4.50	3.50	4.50
Calcium arsenate, dr		lb.	.06½	.07	.06	.06½
Calcium carbide, drums		lb.	.05	.05	.05	.05
Calcium chloride, fused, dr., wks		ton	21.00	21.00	20.00	20.00
Carbon bisulphide, drums		lb.	.05	.05	.05	.05
Carbon tetrachloride, drums		lb.	.06½	.06½	.06½	.06½
Chlorine, liquid, tanks, wks		lb.	.03½	.03½	.03	.03
Cobalt, oxide, bbl		lb.	2.10	2.10	2.10	2.10
Copperas, bulk, f.o.b. wks		ton	16.00	16.00	16.00	16.00
Copper carbonate, bbl		lb.	.17	.17	.16½	.16½
Copper sulphate, bbl	100	lb.	5.00	5.50	5.00	5.50
Cream of tartar, bbl		lb.	.27	.27½	.27	.27½
Epsom salt, dom., tech., bbl	100	lb.	1.75	1.75	1.75	1.75
Epsom salt, imp., tech., bags	100	lb.	1.15	1.15	1.15	1.15
Ethyl acetate, drums		gal.	.81	.87	.81	.87
Formaldehyde, 40%, bbl		lb.	.08½	.09½	.08½	.09½
Fusel oil, crude, drums		gal.	1.30	1.30	1.30	1.30
Glaubers salt, bags	100	lb.	1.00	1.10	1.00	1.10
Glycerine, c.p., drums, extra		lb.	.20	.20	.14	.14
Lead:						
White, basic carbonate, dry, casks		lb.	.09	.09	.08½	.08½
White, basic sulphate, casks		lb.	.08½	.08½	.07½	.07½
Lead acetate, white crys., bbl		lb.	.14½	.14½	.13	.13
Lead arsenate, powd., bbl		lb.	.12	.13	.12	.13
Lithopone, bags		lb.	.05½	.05½	.05½	.05½
Magnesium carb., tech., bags		lb.	.07½	.07½	.06½	.06½
Methanol, 90%, dr		gal.	.53	.55	.43	.55
Methanol, 97%, dr		gal.	.55	.55	.43	.55
Nickel salts, double, bbl		lb.	.10	.13	.10	.13
Nickel salts, single, bbl		lb.	.10½	.13	.10½	.13
Phoaphorus, red, cases		lb.	.62	.62	.62	.62
Potassium bichromate, casks		lb.	.08½	.08½	.08½	.08½
Potassium carbonate, 80-85%, calcined, casks		lb.	.05½	.05½	.05½	.05½
Potassium chlorate, powd		lb.	.08½	.08½	.06½	.07½
Potassium hydroxide (caustic potash) drums		lb.	.07½	.07½	.07½	.07½
Potassium muriate, 80%, bags		ton	36.40	36.40	36.40	36.40
Potassium nitrate, bbl		lb.	.06	.06	.06	.06
Potassium permanganate, drums		lb.	.15	.16	.15	.16
Potassium prussiate, red, casks		lb.	.38	.40	.38	.39
Potassium prussiate, yellow, casks		lb	.18	.19½	.18	.19
Salammoniac, white, imp., casks		lb.	.05	.05	.046	.046
Salsoda, bbl	100	lb.	.90	.90	.90	.90
Soda ash, light, 50%, bags, contract	100	lb.	1.32	1.32	1.32	1.32
Soda, caustic, 76%, solid, drums, contract	100	lb.	2.80	2.80	2.80	2.80
Sodium, acetic, workd, bbl		lb.	.04½	.04	.04½	.05
Sodium bicarbonate, 330-lb. bbl	100	lb.	2.00	2.00	2.00	2.00
Sodium bicarbonate, casks		lb.	.06½	.07	.06½	.07
Sodium chlorate, kegs		lb.	.06½	.06½	.05½	.06½
Sodium cyanide, cases, dom		lb.	.18	.18	.18	.18
Sodium fluoride, bbl		lb.	.08½	.09	.08½	.08½
Sodium nitrate, bags	100	lb.	2.40	2.40	2.15	2.15
Sodium nitrate, casks		lb.	.08	.08	.07½	.07½
Sodium phosphate, dibasic, bbl		lb.	.03½	.03½	.03	.03
Sodium prussiate, yellow, drums		lb.	.12	.12	.11	.11½

Industrial Chemicals—*Continued*

			Jan. 1	High	Low	Dec. 31
Sodium silicate (40-, drums)	100	lb.	$0.75	$0.75	$0.75	$0.76
Sodium sulphide, fused, 60-62%, drums	100	lb.	.03½	.03½	.02½	.02½
Sodium sulphite, crys., bbl		lb.	.02½	.02½	.02½	.02½
Strontium nitrate, powd., bbl		lb.	.09	.09	.09	.09
Sulphur, crude at mine, bulk		ton	18.00	18.00	18.00	18.00
Tin bichloride, bbl		lb.	.17½	.17½	.14½	.15½
Tin oxide, bbl		lb.	.64	.64	.53	.54
Tin crystals, bbl		lb.	.42	.42	.36½	.37½
Zinc chloride, gran., bbl		lb.	.06½	.06½	.06½	.06½
Zinc oxide, lead free, bag		lb.	.06½	.06½	.06½	.06½
5% lead sulphate, bags		lb.	.06½	.06½	.06½	.06½
Zinc sulphate, bbl	100	lb.	2.75	2.75	2.75	2.75

Coal-Tar Products

Alpha-naphthol, crude, bbl		lb.	$0.60	$0.60	$0.60	$0.60
Alpha-naphthol, ref., bbl		lb.	.85	.85	.80	.80
Alpha-naphthylamine, bbl		lb.	.35	.35	.32	.32
Analine oil, drums, extra		lb.	.15	.15	.14½	.14½
Analine salts, bbl		lb.	.24	.24	.24	.24
Benzaldehyde, U.S.P., dr		l.b	1.15	1.15	1.15	1.15
Benzene, 90%, tanks, works		gal.	.24	.24	.23	.23
Ben.idine base, bbl		lb.	.70	.70	.65	.67
Benzoic acid, U.S.P., kegs		lb.	.58	.60	.57	.60
Benzyl chloride, tech., drums		lb.	.25	.25	.25	.25
Beta-naphthol, tech., bbl		lb.	.22	.22	.22	.22
Beta-naphthylamine, tech		lb.	.65	.65	.65	.65
Cresol, U.S.P., drums		lb.	.18	.18	.14	.14
Cresylic acid, 90%, drums, works		gal.	.61	.73	.61	.65
95-97%, drums, works		gal.	.55	.62	.55	.58
Diethylaniline, drums		lb.	.58	.58	.55	.55
Dimethylaniline, drums		lb.	.28	.28	.27	.27
Dinitrophenol, bbl		lb.	.31	.31	.30	.30
Dinitrotoluene, bbl		lb.	.17	.17	.17	.17
Diphenylamine, bbl		lb.	.45	.45	.42	.42
H-acid, bbl		lb.	.63	.63	.60	.60
Monochlorbenzene, drums		lb.	.10	.10½	.10	.10
Monethylaniline, drums		lb.	1.10	1.10	1.05	1.05
Naphthalene, flake, bbl		lb.	.04½	.05	.04½	.04½
Naphthalene, balls, bbl		lb.	.05½	.06	.05½	.05½
Naphthionate of soda, bbl		lb.	.56	.56	.54	.54
Nitrobenzene, drums		lb.	.09	.09	.09	.09
N-W acid, bbl		lb.	.85	.85	.85	.85
Ortho-aminophenol, kegs		lb.	2.25	2.25	2.15	2.15
Ortho-dichlorbenzene, drums		lb.	.08	.08	.08	.08
Ortho-nitrophenol, bbl		lb.	.90	.90	.85	.85
Ortho-toluidine, bbl		lb.	.25	.25	.25	.25
Para-aminophenol, base, kegs		lb.	1.10	1.10	1.05	1.05
Para-dichlorbenze,e, bbl		lb.	.17	.18	.17	.17
Para-nitroaniline, bbl		lb.	.52	.55	.51	.55
Para-nitrotoluene, bbl		lb.	.28	.28	.28	.28
Para-phenylenediamine, bbl		lb.	1.20	1.20	1.15	1.15
Para-toludine, bbl		lb.	.38	.40	.38	.38
Phthalic anhydride, bbl		lb.	.21	.21	.20	.20
Phenol, U.S.P., dr		lb.	.18	.18	.13	.13
Picric acid, bbl		lb.	.30	.30	.30	.30
Resorcinol, tech., kegs		lb.	1.30	1.30	1.30	1.30
R-salt, bbl		lb.	.47	.47	.44	.44
Salicylic acie, tech., bbl		In.	.30	.37	.30	.37
Salicylic acid, U.S.P., bbl		lb.	.33	.40	.33	.40
Solvent naphtha, crude, tanks		gal.	.35	.35	.30	.30
Sulphanilic acid, crude, bbl		lb.	.15	.16	.15	.15
Toluidine, mixed, kegs		lb.	.95	.95	.86	.86
Toluene, tank cars, works		gal.	.35	.50	.35	.45
Xylene, 5%, drums		gal.	.45	.45	.45	.45
Xylene, com., tanks		gal.	.36	.36	.36	.30

Oils and Fats

Castor oil, No. 3, bbl		lb.	$0.13	$0.13	$0.12½	$0.13½
Chinawood oil, bbl		lb.	.15½	16	.14½	.14½
Cocoanut oil, Ceylon, tanks, N. Y.		lb.	.08½	.08½	.08½	.08½
Corn oil, crude, tanks (f.o.b. mill)		lb.	.09½	.09½	.08½	.08½
Cotton seed oil,crude (f.o.b.mill),tanks		lb.	.08½	.09	.0.½	.08½
Linseed oil, raw, car lots, bl		lb.	.10	.104	.096	.10
Palm, Lagos, casks		lb.	.08	.09½	.08	.09½
Niger, casks		lb.	.07½	.09	.07½	.09
Peanut oil, crude, tanks (mill)		lb.	.09½	.10	.09½	.10
Rapeseed oil, refined, bbl		gal.	.85	.90	.84	.84
Soya bean, tank, (f.o.b. coast)		lb.	.09½	.10	.09½	.10
Sulphur (olive foots), bbl		lb.	.10	.10½	.10	.10½
Cod, Newfoundland, bbl		gal.	.63	.69	.63	.65
Menhaden, light pressed, bbl		gal.	.60	.62	.60	.60
Crude, tanks (f.o.b. factory)		gal.	.44	.48	.41	.48
Grease, yellow, loose		lb.	.06½	.07½	.06½	.07½
Oleo Stearine		lb.	.12½	.12½	.09½	.10½
Red oil, distilled, d.p. bbl		lb.	.09½	.09½	.09½	.09½
Tallow, extra, loose		lb.	.08½	.09½	.08	.09½

Miscellaneous

Parafine wax, crude, 124 m.p. bg		lb.	$0.05½	$0.05½	$0.05½	$0.05½
Rosin, H, bbl	100	lb.	8.00	9.90	8.00	9.40
Turpentine, spirits, bbl		gal.	.56	.63	.51½	.61

CURRENT PRICES *in the* NEW YORK MARKET

For Chemicals, Oils and Allied Products

The following prices refer to round lots in the New York Market. Where it is the trade custom to sell f.o.b. works, quotations are given on that basis and are so designated. Prices are corrected to January 12.

Industrial Chemicals

		Current Price	Last Month	Last Year
Acetone, drums	lb.	$0.14 -$0.15	$0.14 -$0.15	$0.12 -$0.13
Acid, acetic, 28%, bbl.	cwt.	3.88 - 4.03	3.88 - 4.03	3.38 - 3.63
Boric, bbl.	lb.	.06½- .07	.06½- .07	.08½ - 08½
Citric, kegs	lb.	.46 - .47	.46 - .47	.45 - .47
Formic, bbl.	lb.	.11 - .12	.11 - .12	.11 - .12
Hydrofluoric 30% carb.	lb.	.06 - .07	.06 - .07	.06 - .07
Lactic, 44%, tech., light, bbl.	lb.	.12 - .12½	.12 - .12½	.13½- .14
22%, tech., light, bbl.	lb.	.05½- .06	.05½- .06	.06½- .07
Muriatic, 18°, tanks	cwt.	.85 - .90	.85 - .90	.85 - .90
Nitric, 36°, carboys	lb.	.05 - .05½	.05 - .05½	.05 - .05½
Oleum, tanks, wks.	ton	18.00 -20.00	18.00 -20.00	18.00- 20.00
Oxalic, crystals, bbl.	lb.	.11 - .11½	.11 - .11½	.11 - .11½
Phosphoric, tech., c'bys.	lb.	.08½- .09	.08½- .09	.08½- .09
Sulphuric, 60°, tanks	ton	11.00 -11.50	11.00 -11.50	10.50 -11.00
Tannic, tech., bbl	lb.	.35 - .40	.35 - .40	.35 - .40
Tartaric, powd., bbl.	lb.	.38 - .39	.37½- .38	.36 - .37
Tungstic, bbl.	lb.	1.00 - 1.20	1.00 - 1.20	1.00 - 1.20
Alcohol, ethyl, 190 p'f., bbl.	gal.	2.68½- 2.71	2.68½- 2.71	2.68½- 2.71
Alcohol, Butyl, dr.	lb.	.18½- .19	.18½- .19	.19 - .20
Denatured, 190 proof				
No. 1 special dr.	gal.	.48 -.....	.48 -.....	.48 -.....
No. 5, 188 proof, dr.	gal.	.48 -.....	.48 -.....	.48 -.....
Alum, ammonia, lump, bbl.	lb.	.03½- .04	.03½- .04	.03½- .04
Chrome, bbl.	lb.	.05½- .05½	.05½- .05½	.05½- .06
Potash, lump, bbl.	lb.	.03 - .03½	.03 - .03½	.02½- 03½
Aluminum sulphate, com., bags	cwt.	1.40 - 1.45	1.40 - 1.45	1.40 - 1.45
Iron free, bg.	cwt.	2.00 - 2.10	2.00 - 2.10	2.00 - 2.10
Aqua ammonia, 26°, drums	lb.	.03 - .04	.03 - .04	.03 - .04
Ammonia, anhydrous, cyl.	lb.	.13½-.....	.13½-.....	.13 -.....
Ammonium carbonate, powd. tech., casks	lb.	.12 - .13	.12 - .13	.10½- .14
Sulphate, wks.	cwt.	2.30 -.....	2.40 -.....	2.40 -.....
Amylacetate tech., drums	gal.	1.75 - 2.00	1.75 - 2.00	1.75 - 2.00
Antimony Oxide, bbl.	lb.	.10½- .10¾	.10½- .10¾	.15 - .16
Arsenic, white, powd., bbl.	lb.	.04 - .04½	.04 - .04½	.04 - .04½
Red, powd., kegs	lb.	.09 - .10	.09 - .10	.09½ .10
Barium carbonate, bbl.	ton	57.50 -60.00	57.50 -60.00	50.00 -52.00
Chloride, bbl.	ton	63.00 -70.00	64.00 -70.00	56.00 -58.00
Nitrate, casks	lb.	.07½- .08	.07½- .08	.08 - .08½
Blanc fixe, dry, bbl.	lb.	.03½- .04	.03½- .04	.04 - .04½
Bleaching powder, f.o.b., wks., drums	cwt.	2.00 - 2.10	2.00 - 2.10	2.00 - 2.10
Borax, bbl.	lb.	.02½- .03	.02½- .03	.04 - .04½
Bromine, cs.	lb.	.45 - .47	.45 - .47	.45 - .47
Calcium acetate, bags	cwt.	4.50 -.....	4.50 -.....	3.50 -.....
Arsenate, dr.	lb.	.06½- .07	.06½- .07	.07 - .08
Carbide drums	lb.	.05 - .06	.05 - .06	.05 - .06
Chloride, fused, dr., wks.	ton	20.00 -.....	20.00 -.....	21.00 -.....
Phosphate, bbl.	lb.	.08 - .08½	.07 - .07½	.07 - .07½
Carbon bisulphide, drums	lb.	.05 - .06	.05 - .06	.05½- .06
Tetrachloride drums	lb.	.06½- .07	.06½- .07	.06½- .07
Chlorine, liquid, tanks, wks.	lb.	.03 - .03½	.03 - .03½	.03½- .04½
Cylinders	lb.	.05 - .08	.05 - .08	.05½- .08
Cobalt oxide, cans	lb.	2.10 - 2.20	2.10 - 2.20	2.10 - 2.25
Copperas, bgs., f.o.b. wks.	ton	16.00 -17.00	16.00 -17.00	14.00 -17.00
Copper carbonate, bbl.	lb.	.17 - .17½	.17 - .17½	.17 - .17½
Cyanide, tech., bbl.	lb.	.49 - .50	.49 - .50	.49 - .50
Sulphate, bbl.	cwt.	5.50 - 5.60	5.50 - 5.70	5.00 - 5.10
Cream of tartar, bbl.	lb.	.27½- .28	.27½- .28	.25½ - .27
Diethylene glycol, dr.	lb.	.10 - .15	.10 - .15	.15 - .20
Epsom salt, dom., tech., bbl.	cwt.	1.75 - 2.00	1.75 - 2.00	1.75 - 2.00
Imp., tech., bags	cwt.	1.15 - 1.25	1.15 - 1.25	1.15 - 1.25
Ethyl acetate, drums	gal.	1.03 -.....	1.03 -.....	.83 -.....
Formaldehyde, 40%, bbl.	lb.	.09½ .10	.09½ .10	.08½- .09
Furfural, dr.	lb.	.15 - .17½	.15 - .17½	.15 - .17
Fusel oil, crude, drums	gal.	1.30 - 1.40	1.30 - 1.40	1.30 - 1.40
Refined, dr.	gal.	1.90 - 2.00	1.90 - 2.00	2.50 - 3.00
Glaubers salt, bags	cwt.	1.10 - 1.20	1.10 - 1.20	1.00 - 1.10
Glycerine, e.p., drums, extra.	lb.	.14 - .15	.14 - .15	.21½- .22
Lead:				
White, basic carbonate, dry, casks	lb.	.08½	.08½-	.08½- .....
White, basic sulphate, sck.	lb.	.07½	.07½-	.08 - .....
Red, dry, sck.	lb.	.09½-	.09½-	.10 - .....
Lead acetate, white crys., bbl.	lb.	.13 - .13½	.13 - .13½	.13 - .13½
Lead arsenate, powd., bbl.	lb.	.13 - .14	.13 - .14	.12 - .13
Lime, chem., bulk	ton	8.50 -.....	8.50 -.....	8.50 -.....
Litharge, pwd., csk.	lb.	.08½	.08½-	.09 -.....
Lithopone, bags	lb.	.05½- .06	.05½- .06	.05½- .06½
Magnesium carb., tech., bags	lb.	.06 - .06½	.06½- .07	.07½- .08
Methanol, 95%, dr.	gal.	.55 -.....	.55 -.....	.53 -.....
97%, dr.	gal.	.55	.55 -.....	.55 -.....
Nickel salt, double, bbl.	lb.	.12½ .13	.10 - .10½	.10 - .10
Single, bbl.	lb.	.13 - .12½	.10¼- .11	.10¼- .11½
Orange mineral, csk.	lb.	$0.11½-..	$0.11½-.....	$0.12 -.....
Phosphorus, red, cases	lb.	.55 - .57	.62 - .65	.62 - .65
Yellow, cases	lb.	.32 - .33	.32 - .34	.32 - .33
Potassium bichromate, casks	lb.	.08½- .08¼	.08½- .08¼	.08½- .08¼
Carbonate, 80-85%, calc., csk.	lb	.05½- .06	.05½- .06	.05½- .06
Chlorate, powd.	lb.	.07½- .08½	.07½- .08½	.08½- .09
Cyanide, cs.	lb.	.52 - .55	.52 - .55	.55 - .57
First sorts, csk.	lb.	.08½- .09	.08½- .09	.08½- .09
Hydroxide(c'stic potash) dr.	lb.	.07½- .07¾	.07½- .07¾	.07½- .07½
Muriate, 80% bgs.	ton	36.40 -.....	36.40 -.....	36.40 -.....
Nitrate, bbl.	lb.	.06 - .06½	.06 - .06½	.06 - .07¼
Permanganate, drums	lb.	.16 - .16½	.16 - .16½	.15 - .16
Prussiate, yellow, casks	lb.	.19 - .19½	.19½- .20	.18 - .19
Sal ammoniac, white, casks	lb.	.046 .05	.047- .05	.05 - .05½
Salsoda, bbl.	cwt.	.90 - .95	.90 - .95	.90 - .95
Salt cake, bulk	ton	15.00 -17.00	14.00 -17.00	17.00 -19.00
Soda ash, light, 58%, bags, contract	cwt.	1.32 -.....	1.32 -.....	1.32 -.....
Dense, bags	cwt.	1.35 -.....	1.35 -.....	35 -.....
Soda, caustic, 76%, solid, drums, contract	cwt.	2.80 - 3.00	2.80 - 3.00	.00 - 3.10
Acetate, works, bbl.	lb.	.05 - .05¼	.05½- .06½	.04½- .05
Bicarbonate, bbl.	cwt.	2.00 - 2.25	2.00 - 2.25	2.00 - 2.25
Bichromate, casks	lb.	.07 - .07½	.07 - .07½	.06½- .06½
Bisulphate, bulk	ton	12.00 -15.00	12.00 -15.00	3.00 - 3.50
Bisulphite, bbl.	lb.	.03½- .03¾	.03½- .03¾	.03½- .04
Chlorate, kegs	lb.	.06½- .07	.06½- .07	.06½- .06½
Chloride, tech.	ton	12.00 -14.75	12.00- 14.75	12.00 -14.00
Cyanide, cases, dom.	lb.	.18 - .22	.18 - .22	.18 - .22
Fluoride, bbl.	lb.	.08½- .09½	.08½- .09½	.08½- 09
Hyposulphite, bbl.	lb.	2.50 - 3.00	2.50 - 3.00	2.50 - 3.00
Nitrate, bags	cwt.	2.15 -.....	2.15 -.....	2.40 -
Nitrite, casks	lb.	.07½- .08	.07½- .08	.08 - .08½
Phosphate, dibasic, bbl.	lb.	.03½- .03½	.03 - .03½	.03½- .03½
Prussiate, yel. drums	lb.	.11½- .12	.11½- .12	.12 - .12½
Silicate (36°, drums)	cwt.	.75 - 1.15	.75 - 1.15	.75 - 1.15
Sulphide, fused, 60-62%, dr.	lb.	.02½- .03½	.02½- .03	.03½- .04
Sulphite, crys., bbl.	lb.	.02½- .03	.02½- .03	.02½- .03
Strontium nitrate, bbl.	lb.	.09 - .09½	.09 - .09½	.09 - .09½
Sulphur, crude at mine, bulk	ton	18.00 -.....	18.00 -.....	18.00 -.....
Chloride, dr.	lb.	.04 - .05	.04 - .05	.05 - .05½
Dioxide, cyl.	lb.	.09 - .10	.09 - .10	.09 - .10
Flour, bag	cwt.	1.55 - 3.00	1.55 - 3.00	1.55 - 3.00
Tin bichloride, bbl.	lb.	.15½-.....	.15½-.....	.17½- .....
Oxide, bbl.	lb.	.54 -.....	.56 -.....	.62 - .....
Crystals, bbl.	lb.	.37½-	.38½-	.41 - .....
Zinc chloride, gran., bbl.	lb.	.06½- .06½	.06½- .06½	.06½- .06½
Carbonate, bbl.	lb.	.10 - .11	.10 - .10½	.10 - .11
Cyanide, dr.	lb.	.40 - .41	.40 - .41	.40 - .41
Dust, bbl.	lb.	.08½- .09	.08½- .09	.09 - .10
Zinc oxide, lead free, bag.	lb.	.06½-	.06½-	.06½- .....
5% lead sulphate, bags	lb.	.06½-	.06½-	.06½- .....
Sulphate, bbl.	cwt.	2.75 - 3.00	2.75 - 3.00	2.75 - 3.00

Oils and Fats

		Current Price	Last Month	Last Year
Castor oil, No. 3, bbl.	lb.	$0.12½-$0.13	$0.12½-$0.13	$0.13 -$0.13½
Chinawood oil, bbl.	lb.	.14½-.....	.14½-.....	.18 -.....
Coconut oil, Ceylon, tanks, N. Y.	lb.	.08½-.....	.08½-.....	.08½ - .....
Corn oil crude, tanks, (f.o.b. mill)	lb.	.08½-.....	.08½	.09½ - .....
Cottonseed oil, crude (f.o.b. mill), tanks	lb.	.08½-.....	.08½-.....	.08½- .....
Linseed oil, raw, car lots, bbl.	lb.	.10 -.....	.10 -.....	098 -.....
Palm, Lagos, casks	lb.	.09½-	.09 -.....	.08 - .....
Niger, casks	lb.	.09 -.....	.08½-	.07½ - .....
Palm Kernel, bbl.	lb.	.09½-	.09½-	.09 - .....
Peanut oil, crude, tanks (mill)	lb.	.10 -	.10 -	.09½ -
Rapeseed oil, refined, bbl.	gal.	.83 - .85	.82 - .84	.82 - .84
Soya bean tank (f.o.b. Coast)	lb.	.10 -.....	.09½-	.09½ .....
Sulphur (olive foots), bbl.	lb.	.10½- *	.10½-	.10 -.....
Cod, Newfoundland, bbl.	gal.	.65 - .67	.65 - .67	.63 - .65
Menhaden, light pressed, bbl	gal.	.62 - .63	.60 - .61	.60 - .62
Crude, tanks (f.o.b. factory)	gal.	.48 -.....	.48 -.....	.44 -.....
Whale, crude, tanks	gal.	.80 -.....	.78 -.....	.....
Grease, yellow, loose	lb.	.07½-	.07½-	.07½- .....
Oleo stearine	lb.	.10½-	.10½-	.10½- .....
Red oil, distilled, d.p. bbl.	lb.	.09½- .10	.09½- .09¾	.09½- .09¾
Tallow, extra, loose	lb.	.09½-	.09½-	.08½- .....

Coal-Tar Products

		Current Price	Last Month	Last Year
Alpha-naphthol, crude, bbl.	lb.	$0.60 -$0.65	$0.60 -$0.65	$0.60 -$0.62
Refined, bbl.	lb.	.80 - .85	.80 - .85	.85 - .90
Alpha-naphthylamine, bbl.	lb.	.32 - .34	.32 - .34	.35 - .36
Aniline oil, drums, extra.	lb.	.14½- .15	.14½ .15	.15 - .16
Aniline salts, bbl.	lb.	.24 - .25	.24 - .25	.24 - .25
Anthracene, 80%, drums	lb.	.60 - .65	.60 - .65	.60 - .65

Coal Tar Products (Continued)

	Current Price	Last Month	Last Year
Benzaldehyde, U.S.P., dr.... lb.	1.15 - 1.25	1.15 - 1.35	1.15 - 1.25
Benzidine base, bbl.... lb.	.67 - .70	.65 - .70	.70 - .72
Benzoic acid, U.S.P., kgs.... lb.	.57 - .60	.57 - .60	.58 - .60
Benzyl chloride, tech, dr.... lb.	.25 - .26	.25 - .26	.25 - .26
Benzol, 90%, tanks, works.. gal.	.23 - .25	.23 - .25	.24 - .25
Beta-naphthol, tech., drums. lb.	.22 - .24	.22 - .24	.22 - .24
Cresol, U.S.P., dr.... lb.	.14 - .17	.14 - .17	.18 - .20
Cresylic acid, 97%, dr., wks. gal.	.73 - .75	.73 - .75	.61 - .62
Diethylaniline, dr.... lb.	.55 - .58	.55 - .58	.58 - .60
Dinitrophenol, bbl.... lb.	.30 - .32	.30 - .31	.31 - .35
Dinitrotoluen, bbl.... lb.	.17 - .18	.17 - .18	.17 - .18
Dip oil, 25% dr.... gal.	.26 - .28	.28 - .30	.28 - .30
Diphenylamine, bbl.... lb.	.42 - .43	.43 - .45	.45 - .47
H-acid, bbl.... lb.	.60 - .63	.60 - .63	.63 - .65
Naphthalene, flake, bbl.... lb.	.04½- .05	.05 - .06	.04½- .05
Nitrobenzene, dr.... lb.	.09 - .10	.09 - .10	.09 - .10
Para-nitraniline, bbl.... lb.	.55 - .56	.55 - .56	.52 - .53
Para-nitrotoluine, bbl.... lb.	.29 - .31	.28 - .32	.28 - .32
Phenol, U.S.P., drums.... lb.	.13½- .14	.13 - .14	.18 - .19
Picric acid, bbl.... lb.	.30 - .40	.30 - .40	.30 - .40
Pyridine, dr.... lb.	1.75 - 1.90	1.75 - 1.90	3.00 -.....
R-salt, bbl.... lb.	.44 - .45	.44 - .45	.47 - .50
Resorcinal, tech, kegs.... lb.	1.30 - 1.35	1.30 - 1.35	1.30 - 1.40
Salicylic acid, tech., bbl.... lb.	.30 - .32	.30 - .32	.30 - .32
Solvent naphtha, w.w.,tanks. gal.	.30 - .35	.30 -.....	.35 -.....
Tolidine, bbl.... lb.	.86 - .90	.86 - .90	.95 - .96
Toluene, tanks, works.... gal.	.45 -	.40 -	.35 -
Xylene, com., tanks.... gal.	.30 - .40	.30 - .35	.36 - .40

Miscellaneous

	Current Price	Last Month	Last Year
Barytes, grd., white, bbl.... ton	$23.00-$25.00	$23.00-$25.00	$23.00-$25.00
Casein, tech., bbl.... lb.	.15 - .16	.16½ - .17	.17½ - .18
China clay, dom.,f.o.b. mine ton	10.00 -20.00	10.00 -20.00	10.00 -20.00
Dry colors:			
Carbon gas, black (wks.) .lb.	.08 - .13	.07½ - .08	.06½- .07
Prussian blue, bbl.... lb.	.32 - .33	.31 - .33	.33 - .34
Ultramine blue, bbl.... lb.	.06 - .32	.08 - .35	.08 - .35
Chrome green, bbl.... lb.	.30 - .32	.27 - .30	.27 - .30
Carmine red, tins.... lb.	6.00 - 6.50	5.25 - 5.50	5.50 - 5.75
Para toner.... lb.	.70 - .75	.60 - .70	.80 - .90
Vermilion, English, bbl.... lb.	1.90 - 2.00	1.80 - 1.85	1.80 - 1.85
Chrome yellow, C. P., bbl.lb.	.16 - .16½	.15½ - .16	.17 - .18
Feldspar, No. 1 (f.o.b. N. C.) ton	5.75 - 7.00	5.75 - 7.00	5.75 - 7.00
Graphite, Ceylon, lump, bbl .lb.	.08 - .08½	.08 - .08½	.08 - .09
Gum copal, Congo, bags.... lb.	.07½ - .08	.07½ - .08	.07½ - .08
Manila, bags.... lb.	.16 - .17	.15 - .16	.15 - .18
Damar, Batavia, cases.... lb.	.24 - .25	.22 - .23	.25 - .25
Kauri, No. 1 cases.... lb.	.48 - .53	.48 - .53	.48 - .53
Kieselguhr (f.o.b. N. Y.).... ton	50.00 -55.00	50.00 -55.00	50.00 -55.00
Magnesite, calc.... ton	40.00 -.....	40.00 -.....	44.00 -.....
Pumice stone, lump, bbl.... lb.	.05 - .07	.05 - .08	.05 - .07
Imported, casks.... lb.	.03 - .40	.03 - .40	.03 - .35
Rosin, H.... bbl.	9.50 -.....	9.50 -.....	10.30 -.....
Turpentine.... gal.	.59 -.....	.59 -.....	.63 -.....
Shellac, orange, fine, bags.. lb.	.61 -.....	.61 -.....	.56 - .59
Bleached, bonedry, bags.. lb.	.56 - .60	.56 - .58	.59 - .61
T. N. bags.... lb.	.43 - .44	.46 - .47	.52 - .54
Soapstone (f.o.b. Vt.), bags..ton	10.00 -12.00	10.00 -12.00	10.00 -12.00
Talc, 200 mesh (f.o.b. Vt.)... ton	9.50 -.....	9.50 -.....	10.50 -.....
300 mesh (f.o.b. Ga.).... ton	7.50 -10.00	7.50 -10.00	7.50 -11.00
225 mesh (f.o.b. N. Y.).... ton	13.75 -.....	13.75 -.....	13.75 -.....

	Current Price	Last Month	Last Year
Wax, Bayberry, bbl.... lb.	$0.30 - $0.32	$0.31 - $0.32	$0.24 - $0.26
Beeswax, ref., light.... lb.	.41 - .42	.41 - .42	.43 - .45
Candelilla, bags.... lb.	.22 - .23	.23 - .24	.27 - .28
Carnauba, No. 1, bags.... lb.	.40 - .41	.46 - .48	.55 - .60
Paraffine, crude 105-110 m.p.... lb	.04¼- .05	.04¼- .05	.05½- .06

Ferro-Alloys

	Current Price	Last Month	Last Year
Ferrotitanium, 15-18%.... ton	$200.00-.....	$200.00-.....	$200.00-.....
Ferromanganese, 78-82%.... ton	105.00-.....	105.00-.....	100.00-.....
Spiegeleisen, 19-21%.... ton	33.00-.....	32.00-.....	30.00-32.00
Ferrosilicon, 14-17%.... ton	45.00-.....	45.00	33.00-38.00
Ferrotungsten, 70-80%.... lb.	1.04 - 1.10	.95 - .98	95 - 98
Ferro-uranium, 35-50%.... lb.	4.50-.....	4.50-.....	4.50-.....
Ferrovanadium, 30-40%.... lb.	3.15- 3.75	3.15- 3.75	3.15- 3.75

Non-Ferrous Metals

	Current Price	Last Month	Last Year
Copper, electrolytic.... lb.	$0.16¼-.....	$0.16 -.....	$0.13½-.....
Aluminum, 96-99%.... lb.	24 - 26	24 - 26	25 - 26
Antimony, Chin. and Jap.... lb.	09¾	11½	10½-.....
Nickel, 99%.... lb.	35	35 -.....	35 -.....
Monel metal, blocks.... lb.	28	28 - 28	32 - 33
Tin, 5-ton lots, Straits.... lb.	49 -.....	49 -.....	58½-.....
Lead, New York, spot.... lb.	6 50 -.....	6 50 -.....	6 50 -.....
Zinc, New York, spot.... lb.	6 70 -.....	6.70 -.....	6.15 -.....
Silver, commercial.... oz.	57½-.....	57½-.....	57½-.....
Cadmium.... lb.	.85 - .95	.70 - .80	60 -
Bismuth, ton lots.... lb.	1 70 -.....	1.70 -.....	1 85 - 2.10
Cobalt.... lb.	2 10 - 2.50	2.50 -	2 50 -.....
Magnesium, ingots, 99%.... lb.	85 - 1.10	85 - 1.10	75 - .80
Platinum, ref.... oz.	70 00 72.50	76 00 - 76.50	72 00 -.....
Palladium, ref.... oz.	42 00 - 46.00	42 00 - 46.00	50 00 52.00
Mercury, flask.... 75 lb.	122 00-.....	122.00 -	128 00-.....
Tungsten powder.... lb.	1.10 - 1.15	1.10 - 1.15	1 05-.....

Ores and Semi-finished Products

	Current Price	Last Month	Last Year
Bauxite, crushed, wks.... ton	$7.50- $8.00	$7.50- $8.50	$5.50- $8.75
Chrome ore, c.f. post.... ton	22.00- 25.00	22.00- 24.00	22.00- 23.00
Coke, fdry., f.o.b. ovens.... ton	2.85- 3.00	2.85- 3.00	3.25- 3.75
Fluorspar, gravel, f.o.b. Ill....ton	18.00- 20.00	17.00- 18.00	17.00-.....
Ilmenite, 52% TiO_2, Va.... lb.	.00¾ .00¾	00¾- .00¾	.00¾- .....
Manganese ore, 50% Mn., c.i.f. Atlantic Ports.... unit	.34 - .37	.36 - .38	.36 - .38
Molybdenite, 85% MoS_2 per lb. MoS_2, N. Y.... lb.	.48 - .50	.48 - .50	48- .50
Monazite, 6% of ThO_2.... ton	130.00-.....	130.00-.....	120.00-.....
Pyrites, Span. fines, c.i.f.... unit	.13 -.....	.13 -.....	.13½-.....
Rutile, 94-96% TiO_2.... lb.	.11 - .13	.11 - .13	.11 - .13
Tungsten, scheelite, 60% WO_3 and over.... unit	11.25 -11.50	11.25 -11.50	11.25 -11.50
Vanadium ore, per lb. V_2O_5.. lb.	.28	nom.	.25 - .28
Zircon, 99%.... lb.	.03 -.....	.03 -.....	.03 -.....

CURRENT INDUSTRIAL DEVELOPMENTS

New Construction and Machinery Requirements

Borax Plant — Pacific Coast Borax Co., Wilmington, Calif., awarded contract for 50 x 800 ft. warehouse for borax plant, to Lange & Bergstrom, Washington Bldg., Los Angeles, Calif. Estimated cost $100,000.

Brass Plant—Anaconda American Brass Co., 8th St., New Toronto, plans the construction of 2 or 3 story addition to brass plant. Estimated cost $500,000. Private plans.

Carbon Factory—Continental Carbon Co., 13904 Lorain Ave., Cleveland, O. S. H. Fleming, Pres., awarded contract for the construction of 1 story, 36 x 546 ft. and 2 story, 45 x 130 ft., plant additions, at 13904 Lorain Ave. to David Gilchrist, Berea, O. Estimated cost $50,000.

Chemical Plant—Grasselli Chemical Co., Div. of E. I. du Pont de Nemours, Wilmington, Del., plans the construction of first unit chemical plant, at Ecorse (mail Detroit), Mich. Estimated cost $1,000,000. Private plans.

Chemical Plant — Charles Lennig Co., Richard and Kennedy Sts. Philadelphia, Pa. awarded contract 2 story, 70 x 129 ft., and 33 x 33 ft. chemical factory, to Knapf & Kohlmeyer, 3543 Germantown Ave., Philadelphia, Pa.

Chemical Plant—Kentucky Color & Chemical Co., 34th St., Louisville, Ky., plans the construction of chemical plant, on 10 acre site, on Belleville Turnpike, Kearney, N. J. Estimated cost $40,000. Engineer and architect not announced.

Chemical Factory—Richards & Co., Inc., Ludlow St., Stamford, Conn., awarded contract for the construction of 1 and 3 story, chemical factory, to J. W. Ferguson & Co., 152 Market St., Paterson, N. J. Estimated cost $70,000.

Chemical and Laboratory Apparatus — Bd. of Trustees of College of City of New York, M. J. Stroock, Chn., 139th St. and Convent Ave., New York, N. Y., will receive bids until Jan. 21 for chemicals and laboratory apparatus.

Clay Factory—American Clay Forming Co., Tiffin, O., awarded contract for the construction of packing and shipping plants and 2 kilns, to L. Tyler, Tiffin. Estimated cost $50,000.

Coke Plant—Koppers Seaboard Coke Co., 504 Union St., Brooklyn, N. Y., awarded contract for the construction of 2 story, coke distribution plant, Getty Ave., to Rust Engineering Co., Clifton, N. J. Estimated cost $150,000.

Chromium Plant—U. S. Chromium Corp., Pittsburgh, Pa., awarded contract for a 1 story, 72 x 100 ft. plant at Pitt and Wallace Sts., to Lambert & Youngh, 1010 Center Ave., Wilkinsburg, Pa. Estimated cost $40,000.

Creosoting Plant—Gulf States Creosoting Co., Hattiesburg, Miss., and 4431 Court St., Birmingham, Ala., plans the construction of plant for creosoting green state telephone poles, cross arms, cross ties, etc., at Birmingham, Ala. Estimated cost $350,000.

Electrolytic Zinc Plant — Evans-Wollower Lead Co., Joplin, Mo., awarded contracts for the construction of a plant for the production of electrolytic zinc including shops, etc., at East St. Louis, Ill.

Fabrikoid Plant — Canadian Fabrikoid Co., 22nd St., New Toronto, Ont., plans the construction of 2 or 3 story, addition,, to fabrikoid plant. Estimated cost $100,000. Canadian Industries Ltd., Canadian Cement Bldg., Montreal, Que., is engineer and architect.

Ferric Chloride — Sewerage Comn., 508 Market St., will receive bids until January 18 for ferric chloride in solution in an amount approximately 1,500 to 2,500 tons anhydrous basis, in tank cars for 1 year, Contract 249; furnishing 6 cylindrical steel tanks, 6 ft. x 6 in. x 36 ft., Cont. 257, also to line with rubber, 6 steel tanks to hold chloride solution, Cont. 258.

Fibroc Factory—Fibrock Insulating Co., Valparaiso, Ind., plans the construction of a 1 story, 112 x 350 ft. factory including alcohol recovery plant. Estimated cost $100,000. Lockhart & Fett, 457 Associated Bldg., Valparaiso, are engineers.

Firebrick Plant—Plibrico Jointless Firebrick Co., New York Ave., Trenton, N. J., awarded contract for the construction of a firebrick plant to Nicholson Co., 247 Park Ave., New York, N. Y. Estimated cost $100,000.

Gas Generating Plant—Atlantic Gas Co., Lewis Bldg., Philadelphia, Pa., N. H. Gellert, Lexington, N. C., V. Pres., has been granted franchise to construct a central gas generating plant at Reidsville, N. C.

Gas Generating Plant — Jersey Central Power & Light Co., 20 South St., Asbury Park, N. J., plans the construction of a 1 story gas generating plant at Montville, N. J. Estimated cost $40,000. Architect not selected.

Gasoline Plant—Phillips Petroleum Co., Abilene, Tex. and Bartlesville, Okla. plans the construction of 4 unit casinghead gasoline plant, in southwest Jones County. Estimated cost $75,000. Private plans.

Glass Factory—American Window Glass Co., Farmers Bank Bldg., Pittsburgh, Pa., taking bids for the construction of a window glass factory, including 13 Fourcault glass machines. Estimated cost $1,000,000. Private plans.

Glass Factory — Libbey-Owens Sheet Glass Co., Nicholas Bldg., Toledo, O., awarded general contract for the construction of additions to heating and cutting plants at Charleston, W. Va., to Ageten & Sons, 417 Washington St., Charleston, W. Va. Estimated cost $125,000 to $150,000.

Glass Factory—Plate & Sheet Glass Co., East Toledo, O., soon takes bids for the construction of an additional unit to sheet and plate glass factory. Estimated cost $4,000,000. Lockwood-Greene Engineers, 24 Federal St., Boston, Mass., are engineers.

Glass Plant Addition—Pittsburgh Plate Glass Co., Frick Bldg., Pittsburgh, Pa., will build a 1 story, 70 x 100 ft. addition to polishing and silvering building at Ford City, Pa. Estimated cost $40,000. Work will be done by separate contracts under the supervision of owners.

Gypsum Plant—U. S. Gypsum Co., 300 West Adams St., Chicago, Ill., awarded contract for the construction of a warehouse for gypsum plant at 58th St. and Schuylkill River, to M. C. Tuttle Co., 31 St. James Ave., Boston, Mass. Estimated cost $150,000.

Heat Treatment Plant—American Gear & Mfg. Co. Park Ave., Jackson, Mich., awarded contract for the construction of 1 story, 60 x 200 ft. heat treating plant to Everett Winters, 1651 East Grand Blvd., Detroit, Mich. Estimated cost $140,000. Owner is in the market for heat treating ovens.

Ink Manufacturing Plant — F. H. Levy Co. 222 44th St., Brooklyn, N. Y., is having plans prepared for the construction of an ink manufacturing plant at Philadelphia, Pa. Architect not announced.

Laboratories—Canadian Salt Co., Sandwich, Ont., plans the construction of 35 x 65 ft. salt laboratory, including equipment. G. M. Duck, is general manager.

Laboratory—Gulf Refining Co., Frick Bldg., Pittsburgh, Pa. plans the construction of 4 story, laboratory, Craft and Emily Sts. Estimated cost $1,000,000. E. E. Appel, c/o owner is engineer.

Laboratory—Midland Steel Products Co., E. J. Kulas, Pres., West 106th St. and Madison Ave., Cleveland, O., awarded contract for a 1 story, 80 x 120 ft. laboratory at Detroit, Mich., to Austin Co., 16112 Euclid Ave., Cleveland, O. Estimated cost $100,000.

Laboratory (Chemical)—Carnegie Institute, 4400 Forbes St., Pittsburgh, Pa., is having plans prepared for the construction of a 2 story chemical laboratory at Stanford University Campus, Palo Alto, Calif. Estimated cost $70,000. J. Bakewell, Jr., 251 Kearny St., San Francisco, Calif., is architect.

Nitrogen Plant—Allied Chemical & Dye Co., 61 Broadway, New York, N. Y., plans the construction of second unit of nitrogen plant at Hopewell, Va. Estimated cost $35,000,000. Private plans.

Oil Distribution Plant—Sinclair Refining Co., 1921 Harrison St., Kansas City, Mo., is having preliminary plans prepared for the construction of an oil storage and distribution plant to include tanks, pumps, etc., at Nebraska City, Neb. Estimated cost $100,000.

Oil Refinery—White Star Refining Co., 903 Grand Blvd., Detroit, plans the construction of 1 and 4 story, oil refinery plant, 9 m.g. capacity crude oil, including storage tanks, cracking stills, fractioning towers, etc. at Aller Rd. Estimated cost $3,000,000. Arthur McKee Co., 2422 Euclid Ave., Cleveland, O. is engineer. Owner will purchase equipment for handling and refining oil and manufacturing gasoline.

Paper Factory—Commercial Papers, Ltd., W. B. Hanna 371 Adelaide St., West Toronto, Ont., plans the construction of a factory for manufacture of safety paper at 314 King St. Estimated cost $50,000. Engineer and architect not selected.

Paint Factory — J. T. Lewis & Bro., Lafayette Bldg., Philadelphia, Pa., awarded contract for a 2 story paint factory at 2545 Aramingo St., to Twiner Construction Co., 1700 Walnut St., Philadelphia. Estimated cost $100,000.

Paint and Varnish Plant—Flint Paint & Varnish Co., Perth Ave., Toronto, Ont., plans the construction of 1 and 2 story, warehouse, etc. Estimated cost $150,000. Engineer and architect not selected.

Pig Iron and Cement Plant — Davison Coke & Iron Co., Oliver Bldg., Pittsburgh, Pa., c/o G. S. Davison, Pres., Gulf Refining Co., awarded contract for the construction of a group of buildings for pig iron and cement plant at Neville Island, to Rust Engineering Co., American State Bldg., Pittsburgh. Estimated cost $1,500,000.

Porcelain Plant — California Porcelain Co., Richmond, Calif., will soon award contract for the construction of a porcelain plant. Estimated cost $40,000. D. E. Jaekle, 395 Justin Way, San Francisco. Calif., is architect.

Rayon—American Glanstoff Corp., 180 Madison Ave., New York, N. Y. plans the construction of 2nd unit rayon yarn plant, at Elizabethton, Tenn. Estimated cost $7,000,000 to $8,000,000. Engineer and architect not selected.

Refinery (Copper Sulphate) — Nicholas Copper Co., Laurel Hill, N. Y., awarded contract for the construction of a copper sulphate refinery at Hobson and Halle Aves., to Laddy & Moore, 70 West 40th St., New York, N. Y.

Refinery—Gulf Refining Co., 21 State St., New York, will build oil refinery, at Mariner's Harbor, Staten Island, N. Y. Work to be done by day labor and separate contracts. Estimated cost $45,000,000.

Refinery—Gulf Refining Co., Gulf Bldg., Houston, Tex., plans the construction of a refinery at Sweetwater, Tex. Estimated cost $2,500,000. Private plans.

Refinery — Little Rock Refining Co., 505 A. O. U. W. Bldg., Little Rock, Ark., is having preliminary plans prepared for a 1 story oil refinery, including laboratory, etc. Estimated cost $60,000.

Refineries — Texas Co., 17 Battery Pl., New York, and 720 San Jacinto St., Houston, Tex., awarded contract 5,000 ton steel for construction of plants at San Antonio and Amarillo and 1,500 tons for plant at Port Arthur to Petroleum Iron Wks., Beaumont, Tex.

Refining and Smelter—Consolidated Mining & Smelting Co., Ltd., of Canada, Troit, B. C., is considering the construction of copper refinery and smelter, probably near Vancouver. Would also handle lead and zinc concentrates. Estimated cost $5,000,000. J. J. Warren is president.

Rubber Plant—Goodyear Tire Co., East Market St., Akron, O., plans the construction of 3 factory units, 400 x 560 ft., 100 x 400 ft., 100 x 400 ft. and power house, at Montgomery, Ala. Estimated cost $7,500,000. Also plans a rubber plant at Regina, Sask. Private plans.

Rubber Plant—Rex-Hide Rubber Co., East Brady, Pa. awarded contract for construction of 1 story, 60 x 160 ft., and 60 x 140 ft. manufacturing plant addition to Austin Co., Union Trust Bldg., Philadelphia, Pa. Estimated cost $50,000.

Rubber Factory—Samson Tire & Rubber Co., 733 East 8th St., Los Angeles, Calif., is having preliminary plans prepared for the construction of a rubber factory at Telegraph Rd. and Atlantic Blvd. Estimated cost $1,000,000. Morgan, Walls & Elements, 1134 Van Nuys Bldg., Los Angeles, are architects.

Soap and Perfume Plant—Yardley & Co., (Canada) Ltd., Toronto, Ont. plans the construction of 5 or 6 story, soap and perfume plant and warehouse, Fleet and York Sts. Estimated cost $200,000. Chapman & Oxley, 372 Bay St., are architects.

Sugar Refinery—National Sugar Refining Co. of New Jersey, 129 Front St., Long Island City, N. Y. plans the construction of plant addition, 54th Ave. and 2nd St. Estimated cost $40,000.

Varnish Plant—Lion Varnish Co., Cooper and Proctor Sts., Brooklyn, N. Y., soon lets contract for the construction of 1 story, 50 x 100 ft. varnish plant, Withers St. and Morgan Ave. Estimated cost $25,000. Levy & Berger, 375 Fulton St., are architects.

Zinc Refinery—United Mines Co., London, England, and Parral District, Mexico, making preliminary surveys for the construction of zinc refinery for handling ore from mines in Parral, District, at El Paso, Tex. Estimated cost $4,500,000.

INDUSTRIAL NOTES

SHELL OIL COMPANY is the new name of of the Shell Company of California located at 200 Bush Street, San Francisco, Calif.

LEE WALLIS GIBBONS, in his new location at the Graybar Building, New York, is distributing products of the following firms: Industrial Welded Products Company, Inert Metal Products Company, The Carpenter Steel Company, Globe Steel Tubes Company, Titusville Forge Company, and Anti-Corrosive Metal Products Company, Inc.

THE PFAUDLER COMPANY, Rochester, N. Y., announces the election of its president, E. G. Miner, to the directorate of the Buffalo, Rochester & Pittsburgh Railroad.

INTERNATIONAL COMBUSTION TAR & CHEMICAL CORPORATION is the new name of the F. J. Lewis Manufacturing Company, with offices at 200 Madison Ave., New York, and 2500 South Robey St., Chicago.

THE TIMKEN ROLLER BEARING COMPANY has appointed Judd W. Spray vice-president and general sales manager.

THE GRUENDLER PATENT CRUSHER & PULVERIZER COMPANY, Landreth Building, St. Louis, is now installed in its new plant which was completed in December. A part of the plant is devoted to an experimental room where special grinding and crushing problems are to be studied.

MONSANTO CHEMICAL WORKS, St. Louis, have established a development department to handle technical relations with consumers. L. A. Watt becomes manager and H. O. Parker a member of the staff. In addition, J. A. Berninghaus has been made general manager of sales, J. B. Reynolds, New York office manager, and F. T. Robinson Chicago district sales manager.

SPRACO, INC., is the new merger of the Spray Engineering Company and Spraco Painting Equipment Company. The offices and plant are located at 114 Central St., Somerville, Mass., the officers being T. W. Pelham, chairman; W. B. Thompson, president; F. G. Dennison, vice-president; and W. F. MacDonald, treasurer.

THE TERRY STEAM TURBINE COMPANY, Hartford, Conn., has appointed the Smiley Equipment Company, 202 Carmen Building, Kansas City, Mo., as representative.

THE MAGNETIC MANUFACTURING COMPANY, Milwaukee, Wis., will henceforth use the trade name "Stearns" in addition to "High Duty."

GENERAL REFRACTORIES COMPANY has opened a Boston sales office at Marshall Building, 40 Central St.

THE BROWN INSTRUMENT COMPANY has moved its New York offices into larger quarters at 117 Liberty Street.

SARCO COMPANY, INC., New York, has added D. M. Archer to its engineering department.

THE HILL CLUTCH MACHINE & FOUNDRY COMPANY, Cleveland, has made sales appointments as follows: Lombard Iron Works, Augusta, Ga.; Murray Company, Dallas, Tex.; D. de Treville, Savannah, Ga.; J. G. Iler, Charlotte, N. C.; Cameron & Barkley, Charleston, S. C.; W. G. Moorman, Buffalo, N. Y.

THE SYNTHANE CORPORATION is completing its plants at Oak, Pa., near Philadelphia, for the production of laminated resinous products. R. R. Titus is president of the new company.

THE J. T. BAKER CHEMICAL COMPANY, Phillipsburg, N. J., has reorganized the newly-purchased Taylor Chemical Company under the name of Taylor Chemical Corporation, incorporated in New York.

THE LEIPZIG TRADE FAIR, Leipzig, Germany, will be held this spring from March 3 to 13.

COMBUSTION CORPORATION OF AMERICA announces the appointment of C. F. Weigel as vice-president and general manager of its subsidiary, Hedges-Walsh-Weidner Company, Chattanooga, Tenn.

THE SWARTOUT COMPANY has acquired a plant in Cleveland, where it will move its facilities from Fostoria and Orrville, Ohio.